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THE PAN-PACIFIC ENTOMOLOGIST

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Vol. XXXIV October, 1958 No. 4

ARTHROPOD ENEMIES OF THE LODGEPOLE NEEDLE MINER, RECURVARIA MILLERI BUSCK

(Lepidoptera:Gelechiidae)

G. R. Struble and W. D. Bedard

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Forest Service, U. S. Department of Agriculture

The lodgepole needle miner, *Recurvaria milleri* Busck, has many natural enemies. Studies have shown that the most numerous, in terms of kinds and numbers, are other arthropods. The majority of these are either parasitic or predaceous insects, but some are predaceous mites and spiders. In California, where the needle miner is a major pest of lodgepole pine, its arthropod enemies are important because of the part that they may play in controlling outbreaks.

Natural enemies of the needle miner have been studied in conjunction with other biological investigations of outbreaks over the past 40 years. These studies have shown what kinds of arthropods parasitize or prey upon the needle miner, especially during the larval and pupal stages. This paper contains a compilation of the species of insects, mites, and spiders recorded through 1956 as natural enemies of this forest pest. The exact role of each is not well known, but altogether they probably exert an important influence on needle miner populations.

The studies on which this paper is based have been made in areas where needle-miner outbreaks were in progress. The principle outbreaks have been in the lodgepole pine forests in Yosemite National Park on the headwaters of the Tuolumne River, Tuolumne County, and the Merced River, Mariposa County. There have been three periods of outbreaks in these forests since 1910. The first extended from about 1910 to 1922; the second from about 1933 to 1941; the third started in 1947 and was still active in 1957.

The first published records on natural enemies of the lodgepole

[1] Maintained at Berkeley, California, in cooperation with the University of California.

needle miner are of parasites discovered by Patterson (1921) during studies conducted between 1917 and 1919. Yuill[2] found several more parasitic species in 1937 and later attributed a sudden decline in needle-miner populations to parasitism. More recently, McLeod (1951) published additional information on the parasites of this insect.

Since 1954, investigations on the natural enemies of the needle miner have been intensified, and many additional parasitic species have been discovered. The present list of species known or suspected to be parasites includes representatives of 14 families and 41 genera. Most of them belong to the order Hymenoptera; a few to Diptera.

The only records of predators are those obtained in the most recent studies. Only one of the predaceous species is an insect, belonging to the order Diptera. Of the others, two are mites (Acarina) and the remaining two are spiders (Araneida).

Table 1 contains a list of the arthropod enemies of the lodgepole needle miner.[3] The list is divided into four groups, and in each group the species are listed phylogenetically. The first group includes only parasites that have been reared from needle miner larvae and pupae, leaving no doubt as to their direct association with the host. Some of the species in this group, however, may be hyperparasitic. The next two groups have a more remote association with the host. The second group includes species reared from lodgepole pine foliage infested with needle miner larvae and pupae. The third group includes parasitic species collected near lodgepole pines infested with needle miners. Both of these groups contain species that are probably needle miner parasites, but convincing evidence of this fact is lacking since they were not reared specifically from this host. The fourth group consists of predators, mainly arthropods other than insects found feeding upon needle miner larvae.

---

[2] Yuill, J. S. Life history and control of the lodgepole pine needle miner, *Recurvaria milleri* Busck, in Yosemite National Park. Season of 1938. Forest Insect Laboratory, Berkeley, Calif. (Manuscript report) February 3, 1939.

[3] The assistance of the Insect Identification and Parasite Introduction Section, Entomology Research Division, Agricultural Research Service, U. S. Dept. of Agriculture, is acknowledged in identifying this material. Identifications were made by specialists whose names appear in the table.

Table 1.—Parasites and predators of the lodgepole needle miner

ORDER & FAMILY	GENUS & SPECIES	DETERMINED BY
	Species reared from needle-miner larvae or pupae	
HYMENOPTERA		
BRACONIDAE		
	Meteorus n. sp.	C. F. W. Muesebeck '56
	Apanteles californicus Muesebeck	" "
ICHNEUMONIDAE		
	Scambus aplopappi (Ashmead)	R. A. Cushman '36
	Itoplectis behrensii (Cresson)	(Muesebeck et al, 1951)
	? *Phaeogenes* n. sp. "Probably represents a new genus & species"	L. M. Walkley '56
EULOPHIDAE		
	Sympiesis sp.	B. D. Burks '56
	Dicladocerus n. sp.	" "
	Zagrammosoma americanum Girault	" "
ENCYRTIDAE		
	Copidosoma sp.	" "
PTEROMALIDAE		
	Amblymerus spp.	" "
	Hypopteromalus sp.	" "
CHALCIDIDAE		
	Spilochalcis side (Walker)	" "
	Species reared from needle-miner-infested foliage	
HYMENOPTERA		
BRACHONIDAE		
	Aphidius varigatus Smith	C. F. W. Muesebeck '56
	Eubadizon Probably n. sp.	" "
	Apanteles alticola (Ashmead)	" "
ICHNEUMONIDAE		
	Scambus hispae (Harris)	R. A. Cushman '18
	Cremastus evetriae Cushman	" "
	Itoplectis conquisitor (Say)	L. M. Walkley '56
	Hemiteles sp.	" "
	Horogenes sp.	" "
TRICHOGRAMMATIDAE		
	Trichogramma sp.	A. B. Gahan '36
EULOPHIDAE		
	Sympiesis n. sp.	B. D. Burks '56
	Tetrastichus sp.	" "
	Zagrammosoma n. sp.	" "
	Chrysocharis n. sp.	" "
	Derostenus sp.	" "
	Diaulomorpha n. sp.	A. B. Gahan '36
	Cirrospilus flavaviridis Crawford	" "
	Achrysocharoides n. sp.	" "
	Euderus sp.	" "

Order & Family	Genus & Species	Determined by
Thysanidae		
	Thysanus sp.	B. D. Burks '56
Encyrtidae		
	Aphycus sp.	" '53
	Blastothrix longipennis Howard	" "
	Lyka sp.	" '52
Chalcididae		
	Spilochalcis albifrons (Walsh)	" '55
DIPTERA		
Empididae		
	Tachydromyia sp.	P. H. Arnaud '56
Chamaemyiidae		
	Leucopis sp.	C. W. Sabrosky '53
	Species collected in needle-miner-infested stands	
HYMENOPTERA		
Ichneumonidae		
	Campoletis sp.	L. M. Walkley '56
Mymaridae		
	Ooctonus sp.	B. D. Burks '56
	Polynema sp.	" "
Eulophidae		
	Tetrastichus silvaticus Gahan	B. D. Burks '56
Encyrtidae		
	Syrphophagus sp.	" "
Torymidae		
	Torymus sp.	" '53
Pteromalidae		
	Tridymus sp.	" '56
	Spintherus sp.	" "
Eurytomidae		
	Eurytoma sp.	" "
Platygasteridae		
	Platygaster sp.	C. F. W. Muesebeck '56
Sphecidae		
	Xylocelia sp.	K. V. Krombein '56
	Passaloecus mandibularis (Cresson)	" "
	Species found feeding on needle miner larvae	
DIPTERA		
Empididae		
	Euthyneura sp.	P. H. Arnaud '56
ACARINA		
Anystidae		
	Anystis sp.	E. W. Baker '57

ORDER & FAMILY	GENUS & SPECIES	DETERMINED BY
	ERYTHRAEIDAE	
	Balaustium sp.	" "
ARANEIDA		
	THOMISIDAE	
	Misumenops sp.	R. E. Crabill, Jr. '57
	SALTICIDAE	
	Sitticus sp.	" "

Copidosoma sp. is the only parasite listed in this table which is believed to attack the egg. No parasites or predators have been observed to attack the adult stage of the needle miner.

The value of the different species as control agents has not been carefully determined, but some observations on this point have been made. Patterson (1921) credited 12 per cent of the needle-miner parasitism in 1919 to *Eutelus*[4] n. sp., *Copidosoma* sp., *Epiurus*[4] sp., *Aethecerus* n. sp., *Apanteles* n. sp., *Habrocytus* n. sp., and an unnamed eulophid. In 1939 Yuill[2] reported the most common parasites as *Apanteles californicus* Mues., *Amblymerus* n. sp., *Neoderostenus*[4] n. sp., and *Phaeogenes* n. sp. McLeod[5] reported these same four parasites by relative abundance in rearings made in 1949. He found that *Apanteles* sp. was most numerous, *Amblymerus* sp. next, *Phaeogenes* sp. third, and *Neoderostenus* sp. fourth. However, in material reared in 1951, McLeod reported that *Amblymerus* sp. was most numerous, *Dicladocerus* sp. second, *Apanteles* sp. third, and *Neoderostenus* sp. fourth. Since 1954 the five most common parasites of the needle miner, judged from the consistency with which they have occurred in rearing by the senior author, have been *Apanteles californicus* Mues., *Sympiesis* sp., *Dicladocerus* sp., *Zagrammosoma americanum* Gir., and *Copidosoma* sp.

Parasite species that have occurred most consistently during the last two outbreak periods (1933–1941; 1947 to this writing (1957)) are listed separately in table 2. Four of them—*Apanteles californicus* Mues., *Scambus aplopappi* (Ashm.), *Copidosoma* spp., and *Amblymerus* spp.—also were taken during the previous outbreak (Patterson, 1921).

---

[4] Synonomy: *Eutelus*=*Amblymerus*; *Epiurus*=*Scambus*; *Neoderostenus*=*Achrysocharoides*.

[5] McLeod, J. H. Excerpt from November 1951 monthly report of the Biological Control Investigations Laboratory, University of British Columbia, Vancouver, B. C. (Manuscript report)

Table 2.—Parasites taken most often in latest two needle-miner outbreaks

Order & Family	Genus & Species	Number times collected 1931-37	1953-56	Total
HYMENOPTERA				
Braconidae				
	Apanteles californicus Muesebeck	4	1	5
Ichneumonidae				
	Scambus aplopappi (Ashmead)	3	0	3
Eulophidae				
	Sympiesis sp.	1	3	4
	Dicladocerus sp.	2	3	5
	Zagrammosoma americanum Girault	2	2	4
	Tetrastichus spp.	2	3	5
Encyrtidae				
	Copidosoma spp.	1	4	5
Pteromalidae				
	Amblymerus spp.	3	3	6
Chalcididae				
	Spilochalcis spp.	2	2	4

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McLeod, J. H.
1951. Notes on the lodgepole needle miner, *Recurvaria milleri* Busck (Lepidoptera:Gelechiidae), and its parasites in western North America. Canad. Ent. (83):295:301.

Muesebeck, C. F. W., K. V. Krombein, H. K. Townes, and others
1951. Hymenoptera of America north of Mexico, Nynoptic Catalog. U. S. Dept. Agric., Monog. 2. 1420 pp.

Patterson, J. E.
1921. Life history of *Recurvia milleri* the lodgepole needle miner, in the Yosemite National Park, California. Jour. Agr. Res. 21:127–142 (illus.).

A belated correction: *Sphinx* ("*Spinx*") *sequoiae* Bdv. Under "Notes on the Larvae of Certain Lepidoptera," 1905, Ent. News, XVI: 153, I described what I though to be the egg, larva and pupa of this rather small gray sphinx moth, from Shasta County, California. But the pupa, or pupae did not hatch. What were probably described were the early stages of *Smerinthus jamaicensis* Drury.

As far as I am aware, the early stages of *Sphinx sequoiae* are still unknown, but its caterpillar may well feed upon one of the coniferous trees.—Francis X. Williams.

A STUDY OF THE NORTH AMERICAN GENUS MEGARAFONUS CASEY

(Coleoptera:Pselaphidae)

R. O. SCHUSTER AND G. A. MARSH

The genus *Megarafonus* was proposed by T. L. Casey in 1897 for the single species *M. ventralis* from northern Oregon. A second species, *M. fundus*, was described by Park in 1943 from southern Mexico, discontinuously extending the range by nearly 2100 miles. As a result of newly acquired material, three additional species are included in the genus, two from Oregon which correspond with Casey's original generic diagnosis, and one from north central California which digresses markedly in the male genitalia and other pertinent structures.

In view of some external divergences and the disjunct geographic area, permission to dissect the type of *M. fundus* was requested of Dr. Park. He kindly agreed, and we owe him a sincere debt of gratitude, as the results confirmed suspected genitalic divergence from that of *Megarafonus s. str.* Dr. Park is aware of and in agreement with our treatment of the genus.

The genus now extends from Alaska to Mexico with three areas of differentiation, each represented by a newly proposed subgenus. Further discussion of these areas and representative species will be considered within each species group.

The morphological characters which appear at present to be of generic rank and partially illustrated in figures 1 and 2 are as follows: (1) body pubescence mostly short, but with some long, curved setae; (2) head with two vertexal foveae not connected to frontal sulcus; (3) frontal sulcus open between antennal bases; (4) antennae of eleven segments in both sexes, third segment small, club indistinct, of three segments; (5) maxillary palpi of four segments; (6) abdomen in both sexes of five visible tergites and seven visible sternites; (7) mesocoxae contiguous, coxal cavities not confluent; (8) metacoxae contiguous; (9) two, large, equal tarsal claws.

The following key will separate two related genera, *Caccoplectus* and *Sonoma*, which could possibly be confused with *Megarafonus* and includes the proposed subgenera.

1. Tarsi with single claw ..... *Caccoplectus*
   Tarsi with two equal claws 2
2. Frontal fovea (sulcus) not extending between antennal tubercles ..... *Sonoma*
   Frontal fovea (sulcus) extending between and separating antennal tubercles 3
3. Cervix lacking setae or pubescence; base of male genitalia less than one-third total length, with median longitudinal suture on dorsal surface ..... *Megarafonus, s. str.*
   Cervix with setae or pubescence; base of male genitalia greater than one-third total length, medain longitudinal suture of dorsal surface obsolete 4
4. Cervix with collar of monaxial setae, frontal sulcus nude; base of male genitalia nearly one-half total length; parameres void of apical setae ..... *Nanorafonus*
   Cervical and frontal sulcus filled with frosted squamose pubescence; base of male genitalia one-half total length; parameres with apical setae ..... *Nafonus*

Subgenus Megarafonus Casey

To this subgenus are restricted those species of *Megarafonus, sensu lato*, which have a nude frontal sulcus and cervical area. Also, the male genitalia have a small base, less than one-third the total length and a well developed median dorsal suture.

They occur within the moist coastal conifer forests extending from northwestern California into southern Alaska and may occupy the entirety of this range, being found at both extremes. *M. ventralis* has been recorded from southern Alaska and northern Oregon and will probably occur wherever suitable environments exist between these locations. Two new species are from northwestern and south coastal Oregon, and females of an as yet unidentified species have been taken in Del Norte County, California. It is unlikely that this subgenus will occur much further south in California.

A critical analysis of some twenty external features yielded no characters suitable for species recognition. Therefore, it has been necessary to recognize species of this subgenus on the basis of strikingly different divergences of the asymmetric male genitalia which assume genitalic configurations as indicated in figures 10–14.

As can readily be seen, the asymmetry for any single species,

with the exception of *M. ventralis*, is either to the left or to the right using characteristics of the base for orientation. Furthermore, the possibility that the median lobe may rotate at the point of juncture on the base and thus account for a false sinistral or dextral condition is eliminated since the median lobe is rigidly fused to the base.

Megarafonus (Megarafonus) lentus Schuster and Marsh. n. sp.

Male.—Head 0.43 mm. long×0.48 mm. wide; pronotum 0.51 mm.×0.61 mm.; elytra 0.61 mm.×0.73 mm.

Testaceous; dorsoventrally compressed; facies and proportions of parts as illustrated in figure 1; vestiture mainly short, dense, but with occasional long, curved setae. Head with large eyes, six or seven facets visible from above; two, small vertexal foveae behind posterior margin of eyes; median frontal sulcus (fovea) open anteriorly, widest at center; antennae of eleven verticillate segments, 1.0 mm. long; maxillary palpi of four segments; ventral surface of head without obvious sexual modification. Pronotum with two large foveae at basal angles, and two small basal and one median fovea at the apices of a nearly equilateral triangle, the median within a larger triangular depression. Elytra apparently connate, each elytron with about four major foveae; subhumeral fovea and epipleural sulcus lacking; wings absent. Abdomen of five visible tergites, the first four with lateral margins, the last two with noticeable spiracular pits; seven sternites, the second, third, and fourth with an anterior transverse sulcus, the sixth distally emarginate, the seventh a slightly asymmetric penal plate with rounded apex (fig. 4). Legs simple. Genitalia as illustrated (fig. 10).

Holotype male was collected at Seaside, Clatsop County, Oregon, April 7, 1955, by Vincent D. Roth. Paratype males were collected by Mr. Roth as follows: one male, Seaside, same data as for holotype; two males six miles east of Buxton, Washington County, Oregon, April 6, 1955, and one male Saddle Mountain, Clatsop County, Oregon, June 5, 1955.

The holotype is deposited in the California Academy of Sciences, one paratype in the collection of Dr. Orlando Park, the remaining paratypes in the collection of the California Insect Survey.

The males of this species, as previously indicated are seemingly separable only on the basis of the male genitalia and specifically, the median lobe. The divergence of the median lobe would indicate that *M. lentus* is most distantly removed from its congeners. However, the difference in this structure is not so great as to obscure the relationship to *M. ventralis*. External characters which eventually may be of some diagnostic value

when the range of variation becomes established include the chaetotaxy of the labrum and seventh sternite as well as the relative positions of the elytral fovea. The females of this species have not as yet been associated with the males. However, they differ from the males by having a simple, non-emarginate sixth and apically emarginate seventh ventral abdominal sternite.

MEGARAFONUS (MEGARAFONUS) VENTRALIS Casey

Megarafonus ventralis Casey, Ann. N. Y. Acad. Sci., IX, p. 550.

This species was excellently considered in the original description. It is separable from *M. lentus* on the basis of the male genitalia (fig. 13).

The known records for this species are as follows: Alaska, Massett, Queen Charlotte Island, Rev. Keene. Oregon, Portland, Hubbard and Schwarz; Buxton, Washington County, V. D. Roth.

Unlike the other species of *Megarafonus s. str.*, which have but one condition of asymmetry, *M. ventralis* exhibits both sinistral and dextral male genitalic forms within a single species population. This anomaly is further discussed here as pending further investigation it may well apply to all species of this subgenus.

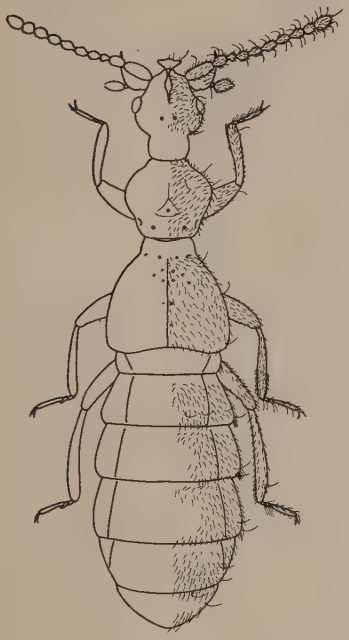
Three males of *M. ventralis* from Buxton, Washington County, Oregon, yielded both genitalic forms, two in which the asymmetry is to the left, and one, a mirror image, in which the asymmetry is to the right.

There is the possibility that the underlying cause for the development of mirror images in the genitalic structure could be a species isolating mechanism. At present, however, we prefer to postulate genitalic variability with one form possibly sterile, instead of sympatric sinistral and dextral species.

In a specimen from Gates, Marion County, Oregon, the genitalic structure (fig. 11) is comparable to *M. ventralis* (fig. 13) but differing mainly in the greater arcuation of the left paramere and median lobe. The degree of difference is not so great that it may not be considered to fall within the probable range of variability of *M. ventralis* even though males of *M. ventralis* from three other localities are rather constant in the shape of this structure.

EXPLANATION OF FIGURES

Fig. 1, dorsal view, male. Fig. 2, head capsule, dorsal view, male. Fig. 3, sixth sternite, male. Fig. 4, seventh sternite male. Fig. 5 seventh sternite, female. Figs. 6, 7, dorsal and lateral views, male genitalia.



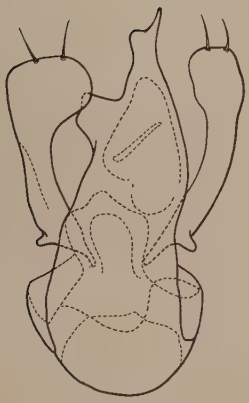
1 lentus

2 parvus

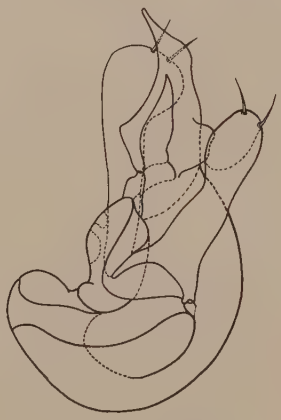
3 ventralis

4 lentus

5 lentus



6 fundus



7 fundus

Megarafonus (Megarafonus) mancus Schuster and Marsh, n. sp.

Male.—Head 0.44 mm. long×0.49 mm. wide; pronotum 0.57 mm.×0.65 mm.; elytra 0.57 mm.×0.81 mm.

As described for *M. lentus* with the exception of the male genitalia (fig. 12).

Holotype and two male paratypes were collected at GOLD BEACH, CURRY COUNTY, OREGON on May 11, 1954 by J. Capizzi.

The holotype is deposited in the California Academy of Sciences, the paratype in the California Insect Survey.

The males of this species are distinct on the basis of the genitalia. The configuration of the median lobe, while unique, combines and exaggerates those characteristics of both *M. lentus* and *ventralis*. The extreme apex of the median lobe has broadened considerably and has an arcuately incised inferior flange which is subtended by an elongate projection shorter than but resembling that of *M. lentus*. Females have not been associated with the males.

The type locality is in south coastal Oregon, closely approximating the extreme southern periphery for the entire distributional range of *Megarafonus s. str.*

Nanorafonus Schuster and Marsh, new subgenus

Type: *Megarafonus parvus*, Schuster and Marsh, new species.

Although similar in many respects to other members of *Megarafonus, s. str.*, the following species has been placed in a new subgenus mainly on the basis of the male genitalia and the presence of monaxial cervical setae. However, other characters such as its considerably smaller size and toothless condition of the mandibular rami may prove to be equally diagnostic.

Megarafonus (Nanorafonus) parvus Schuster and Marsh, n. sp.

Head 0.22 mm. long×0.27 mm. wide; pronotum 0.31 mm.×0.37 mm.; elytra 0.36 mm.×0.46 mm.

Testaceous; vestiture mostly short but with occasional long, peripheral setae. Head shaped as illustrated (fig. 2); two vertexal foveae not connected to frontal sulcus, frontal sulcus open between antennal tubercles; antennae of eleven segments, the third small, the last three forming an indistinct club; mandibles arcuate, the rami essentially toothless; maxillary palpi of four segments, proportioned as in figure 2; sides and bottom of cervix with a collar of monaxial setae. Pronotum with fovea near each lateral basal angle, two small foveae near base and one small median fovea

---

EXPLANATION OF FIGURES

Figs. 8–14, male genitalia (dorsal views excepting fig. 9 which is lateral).

8 parvus

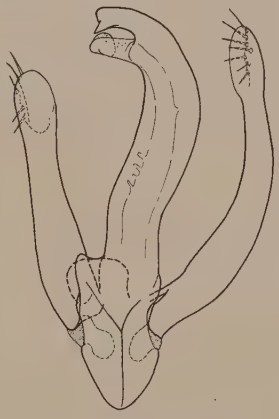
9 parvus

10 lentus

11 ventralis

12 mancus

13 ventralis



14 ventralis

at basal one third. Elytra with fovea at origin of sutural stria and one discal fovea slightly lateral and apical to the former; epipleural foveae and sulcus absent. Abdomen of five visible tergites, the first four with lateral margins, the first three with anterior, transverse pubescent foveae; seven visible sternites, 2, 3, and 4 with transverse pubescent foveae, the sixth emarginate, the seventh an oval penal plate. Legs lacking any particular modification; second tarsal segment partially projecting below elongate third. Genitalia as illustrated (figs 8, 9).

This species is known from a single male, the *holotype*, taken by Berlese funnel from mixed litter of pine, oak, madron, and moss. The sample was collected NEAR STRINGTOWN HILL, NORTH EAST OF OROVILLE, BUTTE COUNTY, CALIFORNIA, February 9, 1956, by R. O. Schuster. The type, a slide mount, is deposited in the California Academy of Sciences.

Nafonus Schuster and Marsh, new subgenus

Type: *Megarafonus fundus* Park

This is a monotypic subgenus most closely allied to *Megarafonus, s. str.*, from which it differs by having prominent areas of frosted squamose pubescence along the posterior margin of the tempora and filling the frontal and cervical sulci. The base of the male genitalia is one-half the total length and lacks a median longitudinal suture. A complete diagnosis of the type will be found in the original description.

MEGARAFONUS (NAFONUS) FUNDUS Park

Megarafonus fundus Park, Bull. Chicago Acad. Sci., Vol. 7, p. 172.

The type was collected by Henry Dybas from Las Vegas, Veracruz, Mexico, at an elevation of 5500 feet. Because the general facies closely approximated that of Casey's *M. ventralis* from Oregon, *M. fundus* was considered congeneric and described as such by Park, thus uniting a Neotropical element with the nearctic. Subsequent dissection of the type and examination of the male genitalia has substantiated Park's original concept in part, but the degree of relationship is not so great that *M. fundus* can still be considered as an integral component of *Megarafonus, s. str.*

FERRIS MEMORIAL ISSUE

The January, 1959 issue of the Pan-Pacific Entomologist is to be dedicated to the Memory of Professor G. F. Ferris and will contain a series of articles relating to his life, teaching and scientific accomplishments.—*Editor*

NOTES ON THE GENUS GAESISCHIA MICHENER, LaBERGE AND MOURE, WITH DESCRIPTIONS OF A NEW SPECIES AND SUBGENUS FROM MÉXICO

(Hymenoptera: Apoidea)

Wallace E. LaBerge

Department of Zoology and Entomology, Iowa State College, Ames, Iowa

The eucerine genus *Gaesischia* previously included a large number of South American species arranged in three subgenera (Moure and Michener, 1955) and one species placed in a fourth subgenus (*G. exul* Michener, LaBerge and Moure) from Arizona, México and Guatemala. Recently, the author discovered in a collection of eucerine bees sent to him for study by the California Insect Survey, University of California, the previously unknown female of *G. exul* together with a new species from México representing an undescribed subgenus. These specimens are described below.

The new subgenus described below is as closely related to the genus *Dasyhalonia* Michener, LaBerge and Moure as it is to the genus *Gaesischia*. It seems necessary, therefore, to group the three subgenera of *Dasyhalonia*, as described by Moure and Michener (1955), together with the subgenera of *Gaesischia* and the new subgenus described below into one genus—*Gaesischia*. This is done below following the descriptive section and a table summarizing the most significant characters of the eight subgenera is included. The position of the new subgenus between the four previously known subgenera of *Gaesischia* and the three subgenera previously grouped in the genus *Dasyhalonia* is clearly shown in this table. In the description given below of the female of *Gaesischia exul* characters of subgeneric or generic value are italicized.

The female of *Gaesischia* does not appear in my key to the eucerine genera of North and Central America (LaBerge, 1957). The female of *G. (Gaesischiana) exul* can be readily separated from other North American eucerine genera by the short broad hind tibiae which are equal in length to no more than the first seven flagellar segments together. The subgenus *Prodasyhalonia*, which is described below, can be readily separated from other North American eucerines by the presence of a strong inner apical spine on the anterior coxa. This spine is at least half the length of the trochanter.

Table I.—Diagnostic characteristics of the subgenera of *Gaesischia*

	Gaesischia	*Gaesischiopsis*	*Agaesischia*	*Gaesischiana*
1.	Head elevated behind ocelli.	Head elevated.	Head elevated.	Head elevated.
2.	Maxillary palpus 5- or 6-segmented.	4-segmented.	5-segmented.	5-segmented.
3.	Clypeus close to eye.	Close to eye.	Close to eye.	Close to eye.
4.	Jugal lobe of hind wing slightly shorter than cubital cell.	Slightly shorter than cubital cell.	Slightly longer than (or subequal to) cubital cell.	Slightly shorter than cubital cell.
5.	Female subapical flagellar segments longer than or sub-equal to width.	Longer than or subequal to width.	Longer than or subequal to width.	Longer than or subequal to width.
6.	Female anterior coxal spine half length of trochanter.	Spine reaching apex of trochanter.	Spine absent.	Spine absent.
7.	Female scopal hairs plumose.	Scopae plumose.	Scopae plumose.	Scopal hairs simple.
8.	Male penultimate flagellar segment more than twice as long as broad.	More than twice as long as broad.	More than twice as long as broad.	More than twice as long as broad.
9.	Male ultimate flagellar segment slightly compressed.	Not at all compressed.	Markedly compressed.	Markedly compressed.
10.	Male fourth and fifth sterna without long bristlelike hairs.	Fifth sternum with subapical row of long, bristlelike, coarse, uncurled hairs.	Without long bristlelike hairs.	Without long bristlelike hairs.
11.	Male sixth sternum with pair of carinae converging posteriorly.	With pair of carinae converging posteriorly.	With pair of carinae converging posteriorly.	With pair of carinae converging posteriorly.

Table 1. Diagnostic characteristics of the subgenera of *Gaesischia*—(Continued)

	Prodasyhalonia	*Dasyhalonia*	*Zonalonia*	*Pachyhalonia*
1.	Head slightly elevated.	Head not elevated.	Head not elevated.	Head not elevated.
2.	5-segmented.	5- or 6-segmented.	6-segmented.	6-segmented.
3.	Clypeus close to eye.	Close to eye.	Separated from eye by one-third minimum flagellar diameter.	Separated from eye by one-third minimum flagellar diameter.
4.	Slightly shorter than cubital cell.	Slightly shorter than cubital cell.	Slightly shorter than cubital cell.	Slightly shorter than cubital cell.
5.	Longer than or subequal to width.	Subapical flagellar segments of female broader than long.	Broader than long.	All flagellar segments of female longer than broad.
6.	Spine longer than half length of trochanter	Spine absent.	Spine absent.	Spine absent.
7.	Scopae plumose.	Scopae plumose.	Scopae plumose.	Scopal hairs serrate but not branched.
8.	More than twice as long as broad.	Penultimate flagellar segment of male less than twice as long as broad.	Less than twice as long as broad.	Less than twice as long as broad.
9.	Markedly compressed.	Not at all compressed, tapering.	Slightly compressed, tapering.	Markedly compressed, tapering.
10.	Male fourth and fifth sterna (often third) with very long, coarse, curled, subapical, bristlelike hairs.	With very long, coarse, curled, subapical, bristlelike hairs.	With very long, coarse, curled, subapical, bristlelike hairs.	With very long, coarse, curled, subapical, bristlelike hairs.
11.	Male sixth sternum with strong median lamella ending in posteriorly directed tooth.	With weakly elevated mediobasal area bearing hair tuft.	With strongly elevated mediobasal area.	With strongly elevated mediobasal area sometimes ending in tooth.

GAESISCHIA (GAESISCHIANA) EXUL Michener, LaBerge and Moure.

Gaesischia exul Michener, LaBerge and Moure, 1955, Dusenia, 6:224–226; LaBerge, 1957, Amer. Mus., no. 1837:34.

Female.—Measurements: Length about 12 mm.; width about 3.5 mm.; wing length (including tegula) about 9 mm. *Color:* Integument black except as follows: labrum, base of mandible and *subapical half of clypeus yellow*; flagellar segments 3 to 10 and apical half of mandible refuescent; legs except coxae yellow to red; tegulae testaceous; wing membranes hyaline, veins dark brownish black; metasomal terga with apices broadly hyaline, yellow; sterna reddish yellow. *Structure and sculpture:* First flagellar segment shorter than second and third together, third equals about seven-eighths of first, segments 3 to 9 subequal, last segment subequal to first. Maxillary palpal segments in ratio of about 2:3:3:1:1; distal part of galeae subequal in length to eye. *Clypeus protruding beyond eye by about half width of eye in profile, protruding surface flat and sharply declivous posteriorly with well-defined carina between flattened and declivous areas.* Galeae shiny above, with extremely delicate reticular shagreening; clypeus coarsely punctate, surface scarcely dulled by delicate cross-striations. Mesoscutum with large shallow punctures separated by half a puncture width, surface (and bottoms of punctures) dulled by extremely fine tessellation especially on anterior half; scutellum and mesepisternum with smaller, deeper, less crowded punctures and surfaces shiny, delicately shagreened; propodeum with dorsal surface subequal to metanotum in length, coarsely punctate with surface delicately shagreened, moderately shiny. *Hind wing with jugal lobe slightly shorter than cubital cell. Anterior coxa without inner apical spine; hind tibia less than four times as long as broad and equal in length to first seven flagellar segments or less;* tibial spurs normal. Metasomal tergum 1 with punctures in basal half separated basally by one or two puncture widths and sparser toward middle of tergum, impunctate apically; terga 2 and 3 with minute round punctures separated mostly by one puncture width in median half and by two puncture widths in apical hyaline area; *tergum 6 with gradulus without lateral parts;* pygidial plate V-shaped, pointed at apex. *Hair:* Head ochraceous, brighter on vertex. Thorax white on lower lateral surfaces to bright ochraceous above. Metasomal tergum 1 with long ochraceous hairs basally, scattered, short, appressed, yellow hairs apically; *terga 2 to 4 with diffuse, short, closely appressed, pale ochraceous pubescence*; terga 5 and 6 with long, pale ochraceous to yellow hairs; sternal hairs yellow medially to pale ochraceous laterally. Legs pale ochraceous except as follows: distitarsi, fore basitarsi, inner surfaces of tibiae and middle and hind basitarsi yellow; basitibial plates covered with yellowish brown hairs; *scopal hairs simple, short, white.*

Distribution.—Southern Arizona, México and Guatemala. The female described above was collected by R. C. Bechtel and E. I. Schlinger on an expedition sponsored by the Associates in Tropical Biogeography, University of California at DONAJI, OAXACA,

MEXICO on April 17, 1953, and is in the collection of the California Insect Survey, University of California at Berkeley.

Prodasyhalonia LaBerge, new subgenus

Type Species—Gaesischia mexicana LaBerge, new species.

Female.—Clypeus with extremely narrow subapical yellow band; maxillary palpus five-segmented. Jugal lobe of hind wing slighty shorter than cubital cell; anterior coxa with inner apical spine more than half length of trochanter; hind tibia more than four times as long as broad, equal in length to about first nine flagellar segments together; tibial spurs normal; scopal hairs plumose. Second tergum with basal and subapical bands of appressed, pale, plumose pubescence; tergum 6 with gradulus with short cariniform lateral parts. See Table I for additional characters.

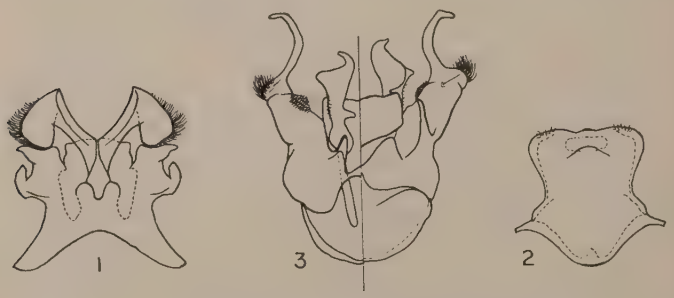
Male.—Maxillary palpus five-segmented; flagellum with segments 4 to 10 subequal in length, last segment much compressed, less than three times as long as broad, penultimate segment normal. Jugal lobe of hind wing slightly shorter than cubital cell; hind basitarsus much flattened; middle tibial spur slightly shorter than from its base to anterior tibiofemoral articulation; anterior coxa without apical spine; second tergum with basal and subapical pale pubescent bands; sternum 5 with very long, apically curled, subapical, coarse, bristlelike hairs; sternum 6 with strong median longitudinal lamella ending posteriorly in a pointed apex; sternum 7 with expanded median plates and lateral plates deeply emarginate laterally. See Table I for additional characters.

Gaesischia (Prodasyhalonia) mexicana LaBerge, new species

Female.—Measurements: Length about 10 mm.; width about 3 mm.; wing length (including tegula) about 7.5 mm. *Color:* Integument black except as follows: clypeus with extremely narrow subapical yellow band; tegulae testaceous posteromedially; wing membranes somewhat infumate, yellow; metasomal terga 1 to 4 narrowly hyaline; apical half of mandible and distitarsi rufescent. *Structure and sculpture:* Flagellum as in *exul* but third segment equals about three-fourths first segment and last segment slightly shorter than first. Maxillary palpal segments in ratio of about 14:14:8:5:6; distal part of galeae slightly shorter than eye. Clypeus protruding beyond eye by less than half width of eye, surface rounded, without sub-basal carina. Galeae dulled above by dense regular tessellation; clypeus with coarse, round, shallow punctures, surface dulled by sparse cross-striations. Mesoscutum with large round punctures separated by half to one puncture width, surface shiny; scutellum similar but punctures more crowded; mesepisternum similar but punctures crowded and slightly shallower; propodeum with dorsal surface subequal in length to metanotum, with distinct round punctures, surface dulled by fine tesselation, posterior surface (except shiny upper triangle) and lateral surfaces coarsely punctate and finely tessellate. Metasomal tergum 1 punctate over about basal eight-ninths, punctures in median area of basal fourth separated by two to four puncture widths, apical to middle separated by half a puncture width or less; terga 2 and 3 as in *exul* but punctures more crowded in apical areas; pygidial

plate V-shaped with rounded apex. *Hair:* Head white except abundant dark brown vertex. Mesoscutum and scutellum with short dark brown hairs except white peripherally; thorax otherwise white. Metasomal tergum 1 with long white hairs in basal half, with short, simple, appressed, dark brown hairs in apical half; tergum 2 with basal and apical bands of white pubescence separated by band of dark brown, appressed, relatively sparse and simple hairs, apical pale band broadly interrupted medially; tergum 3 similar to 2 but interband zone with sparse pale pubescence and apical pale band uninterrupted; terga 4 and 5 covered with diffuse pale pubescence and long brown bristlelike hairs; tergum 6 dark brown; sternal hairs brown medially to white laterally. Legs white except as follows: inner surfaces of basitarsi dark reddish brown; inner surfaces of hind tibiae yellow; outer surfaces of fore and middle tibiae near apices and surrounding basitibial plates pale brown.

Male.—Measurements: Length about 9 mm.; width about 2.5 mm.; wing length (including tegula) about 7 mm. *Color:* Integument black except as follows: clypeus yellow except extreme basal margin and apical margin; flagellar segments 1 to 8 and base of 9 red below, dark brown above; eyes gray; wing membranes slightly infumate, yellow; tarsi and tibiae dark red; terga 1 to 5 with narrow apical margin hyaline, yellow. *Structure and sculpture:* Minimum length of first flagellar segment equals about one-sixth of maximum length of second; maxillary palpae as in female but third segment longest; sculpturing as in female. Thoracic sculpturing as in female. Metasomal sculpturing as in female but terga 3, 4 and 5 similar to tergum 2; sternum 7 with expanded median plate directed laterally with short dorsal and ventral subapical, blunt tubercles. Gonostylus strongly curved with apex directed ventrolaterally, with long stout hairs at base on ventrolateral surface; spicules at apex of gonocoxite short and blunt; apicodorsal process of gonocoxite short, thin, subapical (Figs. 1 to 3). Hair: As in female except as follows: mesocutum and scutellum with less



EXPLANATION OF FIGURES

Figs 1–3—Terminalia of *Gaesischia mexicana*, approximately ×25. 1) Sternum 7, ventral view. 2) Sternum 8, ventral view. 3) Genital capsule, dorsal view at right, ventral view at left.

brown hairs: tergum 2 with apical pale pubescent band reduced to short lateral fasciae each equal to less than one-fourth of width of tergum; tergum 3 like tergum 2 but apical pale band not so broadly interrupted medially; tergum 4 like tergum 3 of female; terga 5, 6 and 7 with ochraceous hairs and pubescence. Legs white to pale ochraceous except inner surfaces of tarsi and tibiae yellow to red.

Type Material.[1]—Female holotype, male allotype, and one female and one male paratype from 4 MILES WEST OF EL JOCOTE, CHIAPAS, MEXICO, were collected on March 4, 1953, by R. C. Bechtel and E. I. Schlinger. In addition, one female and two male paratypes from Chiapas, México, are as follows: one male from 4 miles southeast of Soyalo, February 28, 1953, R. C. Bechtel and E. I. Schlinger; one male from 4 miles northwest of Ocosingo, March 9, 1953, Ray F. Smith; one female from 9 miles south of Ixtapa, March 1, 1953, R. C. Bechtel and E. I. Schlinger. The holotype and allotype are in the collection of the University of California at Berkeley. The paratypes are in the collection of the Universtiy of California and in the Snow Entomological Collection, the University of Kansas, Lawrence.

ACKNOWLEDGMENTS

I am grateful to Dr. P. D. Hurd of the University of California for the loan of specimens in his care. I am also indebted to Dr. C. D. Michener of the University of Kansas for the loan of specimens of the several subgenera of *Gaesischia* and *Dasyhalonia*.

LITERATURE CITED

LABERGE, WALLACE E.
1957. The genera of bees of the tribe Eucerini in North and Central America. The American Mus. Nov., No. 1837:1–44.

MICHENER, C. D., W. E. LABERGE AND J. S. MOURE
1955. Some American Eucerini Bees. Dusenia, 6:213–230.

MOURE, J. S. AND C. D. MICHENER
1955. A contribution toward the classification of Neotropical Eucerini. Dusenia, 6:239–331.

BOOK NOTICES

A LIST OF COLEOPTERA FROM THE VICINITY OF WILLAPA BAY, WASHINGTON. By Melville H. Hatch and Trevor Kincaid. ii+23 pp., 1 map [p. i is the front cover; pp. ii and 22 are blank, 23 is unnumbered and has a map mounted on it]. Privately published. The Calliostoma Company, 1904 East 52nd., Seattle 5, Washington. 1958. Price 50 cents, post paid.

[1] This material was collected in the course of an expedition sponsored by the Associates in Tropical Biogeography, University of California.

This is a list of 493 species of beetles and the localities in which they were taken, from the vicinity of what used to be known as Shoalwater Bay, in the southwestern corner of Washington. Most of the collecting was done by Kincaid; most of the identifications are by Hatch. Set in type and printed by Professor Kincaid, in an edition of 300 copies.

THE GRASSHOPPERS AND LOCUSTS (ACRIDOIDEA) OF AUSTRALIA. Volume III. Family Acrididae: subfamily Cyrtacanthacridinae, tribes Oxyini, Spathosternini, and Praxibulini. By James A. G. Rehn. Melbourne, October, 1957. 273 pp., 29 pls. For sale by Melbourne University Press, University Grounds, Melbourne N. 3, Victoria, Australia. Price £A 2, plus post.

The first two volumes of this series have been noticed in this journal (Vol. 29, No. 1, p. 18; Vol. 30, No. 4, p. 262). The third volume continues the work in the same thorough manner.—HUGH B. LEECH, *California Academy of Sciences, San Francisco.*

A ROSE TIP SAWFLY NEW TO CALIFORNIA

(Hymenoptera: Tenthredinidae)

On May 20, 1949, Mr. Albert Foster[1] collected three larval sawflies boring in rose terminals. These were subsequently identified as possibly *Ardis sulcata* (Cameron), a species which is widely distributed in Europe. Mr. Foster reported them stunting and killing the terminals.

Recently while identifying some sawflies from the collection of the California State Department of Agriculture two adult females of this species were found, thus confirming the presence of this rose pest in California. The specimens were reared from rose buds in May, 1938 from larvae collected April 12, 1937, Soda Creek, Napa County, California by H. H. Keifer. This locality is approximately six miles southwest of Monticello.

Eide[2] reported this species causing injury to Manetti and wild roses near Puyallup, Washington, in 1940. Damaged tips, adults or larvae were observed fairly widespread in Washington and Oregon. He was able to rear a number of adults and gave some interesting biological data.

Keifer's specimens are thus the earliest North American record for this pest of rose, antedating the northwest collections by three years.—WOODROW W. MIDDLEKAUFF, *University of California, Berkeley.*

[1] Then Deputy Agricultural Commissioner, Santa Clara County.

[2] Eide, Paul M., 1948. A tip-infesting sawfly on rose. Jour. Econ. Ent. 41 (5) :819-821.

A NEW GENUS OF THE GERRIDAE FROM THE SOLOMON ISLANDS

HERBERT B. HUNGERFORD AND RYUICHI MATSUDA[1]

In 1954, E. S. Brown collected five specimens of a small gerrid in the Solomon Islands. They have been sent to us for determination by the British Museum. These specimens belong to a new genus and species.

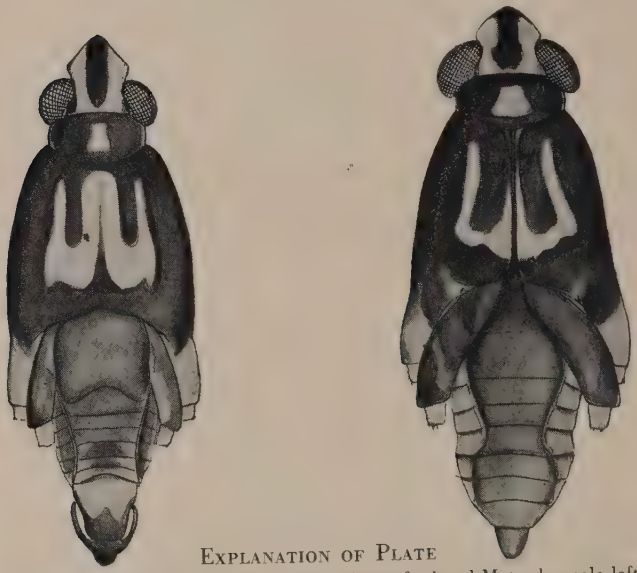
Rheumatometroides Hungerford and Matsuda, new genus

Type species of the genus: *Rheumatometroides browni* Hungerford and Matsuda.

Body elongate, ovate in outline and small, female a little larger than male; head between eyes widened posteriorly; antennal cavity located far anterior to anterior margins of eyes; eyes covering anterolateral angles of pronotum; rostrum extending beyond prosternum, robust, reflexed, first segment long, a little over half as long as head on its ventral surface, third segment thickened and curved as in *Rheumatometra;* antennae slender, first segment with numerous setae as long or longer than diameter of the segment, much longer than second but shorter than second and third segments together. *Pronotum* narrower than head including eyes, more or less produced medially on posterior margin, especially so in female; mesonotum with medially keeled longitudinal groove extending throughout the entire length in female, posterior margin of mesonotum concave; metaacetabula flattened, obliquely converging anteriorly in female; metasternum entire, with omphalium in male; front leg slender, without sexual difference in shape, tibia simply thickened apically, first tarsal segment greaty reduced; middle leg with tibia longer than femur, first tarsal segment a little longer than second segment; hind leg with femur over two and a half times as long as tibia, first tarsal segment shorter than second segment. *Abdomen* with anterior margins of first and second tergites distinct; ninth segment with suranal plate in male with conspicuous spinous process on each side, directed anteriorly; paramere somewhat reduced.

This genus is quite peculiar in the following characters: (1) The first rostral segment is long; (2) In the female the mesonotum is provided with distinct medially keeled longitudinal groove; (3) The omphalium is present in the male; (4) The suranal plate in the male with conspicuous lateral process. In the female of *Rheumatometra philarete* Kirkaldy the mesonotum is also with median longitudinal groove, but only posteriorly. In the genus *Hynesionella* the suranal plate is also with conspicuous process on each side, but this has apparently occurred independently in both genera. The presence of the omphalium is peculiar to this

[1] Contribution No. 996 from the Department of Entomology, University of Kansas. This report is a by-product of a project conducted with the aid of a grant from the National Science Foundation.



EXPLANATION OF PLATE

Plate 1. *Rheumatometroides browni* Hungerford and Matsuda, male left, female right.

genus, in no other related genera is the omphalium recognizable.

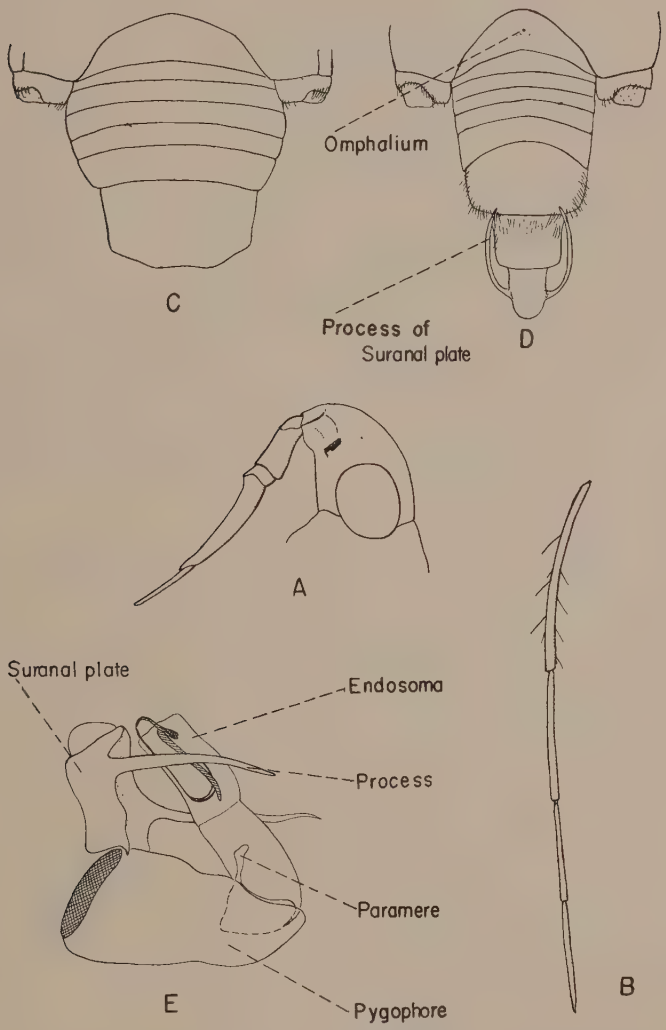
Rheumatometroides browni Hungerford and Matsuda, new species

(Plates 1 and 2)

Size: Apterous male 3.15 mm. long; 1.16 mm. greatest width. Apterous female 3.25 mm. long; 1.26 greatest width. *Color:* Black with testaceous to reddish markings as shown in plate 1; antennae, beak and legs dark except base of anterior femora; mesopleura and metaacetabula with broad black bands, the former with a band of grayish pile superimposed; thoracic venter pale testaceous, abdominal venter more or less embrowned. *Structural characteristics:* Relative length of antennal segments in a male: 1st : 2nd : 3rd : 4th :: 40 : 26 : 21+ : 23–; total antennal length to body length in a male :: 2.6 mm. : 3.15 mm.; rostrum rather stout with third segment extending onto mesosternum; front femur and tibia moderately stout, the former with diameter a little greater than base of middle femur; middle leg

Table 1.—The relative lengths of the leg segments.

	Femur	*Tibia*	*1st tarsal seg.*	*2nd tarsal seg.*	*Total tarsal length*
Front leg	45	40	5.3	18.7	24
Middle leg	110	132	44.3	38.7	83
Hind leg	120	48	7+	13–	20



EXPLANATION OF PLATE

Plate 2. *Rheumatometroides browni* Hungerford and Matsuda, A) Lateral view of the head, B) The male antenna, C) Ventral view of the female abdomen, D) Ventral view of the male abdomen, E) Lateral view of the male genital segment.

much longer than hind leg (325:188); metasternum of male slightly elevated on its median line and with omphalium well recognizable; first four abdominal sternites very short, the following one a little longer and the last one nearly as long as all that precede it in male; first genital segment of male also long and ventrally depressed, with last abdominal segement together considerably longer than preceding abdominal segments; seventh tergite of male as long as five preceding tergites; lateral process of suranal plate of male as shown in plate 1 and plate 2 figure E; paramere somewhat reduced, as shown in plate 2, figure E; last ventral abdominal segment of female large, longer than three preceding segments together; genital segments withdrawn.

This species stands quite alone. The presence of the omphalium in the male, its large process on the suranal plate and so forth separate it from its nearest relatives. It is described from two males and three females bearing the label "Solomon Is. Kolombangara, Jack Harbour. 1, X 1954, E. S. Brown." Holotype, allotype and three paratypes belong to the British Museum. It is hoped that the two dissected paratypes may be deposited in the Francis Huntington Snow Entomological Collections at the University of Kansas.

ERRATA

MURAYAMA, J. J.

1957. Bark-beetles and pine-hole borers recently imported into Japan with timbers from the United States and other foreign countries. Pan-Pacific Ent., 33(1):35–37.

Page	*Line*	
36	13	Barboso read Barbosco
"	20	Douglas fir read Spruce & fir
"	25	1951 read 1953
37		Add a line between the lines 8 & 9: Eureka, ", ", 1954
"	10	1943 read 1953
"	15 & 16	1944 read 1954
"		Cancel the lines 18 & 19 (Port, Species, Subfamily & species etc.)
"	21	Eichhorn read Eichhoff
"	23	" read Sandakan
"	25	Apiton read White fir
"	33	St. Muria read St. Maria
"	28	Nsipit read Nasipit, 1951 read 1953, White fir read Lauan
"	29	Camarives read Camarines, Lauan read Apiton
"		Add a line between the lines 29 & 30: Nasipit, Osaka, Lauan, 1953
"	30	Lauan read Paulownia
"	33, 37 & 38	1951 read 1954
"	26	Stroheim read Strohmeyer, Paulonia read Lauan
"		Add a line between the lines 38 & 39: Appari, Osaka, Lauan, 1954
"	39	*aleajahi* read *aleajalis*, Cancel Appari
"	40	Basilan read Bislig
"	41	Add " , " , 1952

FOUR NEW SPHECID WASPS FROM WESTERN NORTH AMERICA

(Hymenoptera:Sphecidae, Larrinae)

FRANCIS X. WILLIAMS
Reserach Associate, Department of Entomology
California Academy of Sciences

Tribe TACHYTINI

Tachysphex nitelopteroides Williams, new species

(Figure 1)

Female holotype.—Length 6:30 mm. Generally pale reddish: head black, clypeus and antennae except the infuscate 4 apical segments, pale reddish, mandibles except apices, yellowish red; mesosternum in part blackish: middle and hind tarsi slightly infuscate, fore tarsal comb pale yellowish, the spur pale, meso- and metatibial spurs dark: wings mainly hyaline, but in the fore wings there is a feeble infuscate band extending from the costa, through the base of the marginal cell, the apex of the first submarginal cell, all of the second submarginal, and the apex of the second discoidal cell, though diffusing slightly beyond these limits: venation rather pale brown, costa darker, stigma blackish: fourth tergite with some blackish on either side. Vestiture generally sparse, golden on frons, genae and occiput, somewhat silvery on base of clypeus, appressed silvery pile on pleurae and sternum of mesothorax, on disc and apex of propodeum, and an obvious patch laterally on the second tergite. Clypeus shining, disc convex with some large punctures, its produced portion gently outbowed, margin smooth and rather wide, lateral angles strong: mandibles well notched beneath and provided with some rather long pale erect hairs: antennae slender, segments 3 and 4 subequal: frons very finely punctate, giving it a granulate appearance: vertex with many fine separate punctures: the flattened posterior ocelli are shining and there is a depression ending as broad wedge beyond them: interocular space at vertex slightly less than antennal segments 2 plus 3. Thorax smooth and shining, though under greater magnification finely punctured: disc of propodeum coriaceous, posterior face with a smooth area in which there is a wedge-shaped depression in its upper part, the pleurae shining and with fine scattered punctures. Forewings with marginal cell distinctly surpassing third submarginal, second submarginal cell very narrow at marginal cell: in the hindwings the transverse-median crossvein is about half the length of the second abcissa of the median vein. Abdomen shining, pygidium polished, narrow and pointed, bounding carinae very slightly inbowed, disc finely reticulate and with sparse large punctures.

Male allotype.—Length 4 mm. Dorsulum and abdomen shining. Black: clypeal rim, mandibles, palps mostly, basal part of antennae, pronotum, propleurae, wing bases, scutellum except base, and metanotum reddish, legs blackish to deep brown, paler from tibiae apically, posterior legs the darkest: venation brownish. Head finely granulate punctate, more clearly punctate on the shining vertex and clypeus: mandibles sharply pointed, strongly notched beneath: clypeus with the disc convex, the produced part gently

rounded out and with lateral angles, otherwise with no teeth; antennae pilose, with segment 3 slightly shorter than segment 4. Thorax finely punctate; dorsum of propodeum granulate punctate, sides polished, posterior face with a groove. Fore femora beneath near base with a small emargination. Venation as in female. Last visible sternite roundly emarginate, lobes acute. Vestiture (the specimen has been somewhat rubbed): silvery pile on frons, genae, thorax, more or less, base of legs and femora in part, and propodeum, and with a conspicuous patch on side of tergite 2.

Holotype female, La Paz, Baja California, Mexico, October 11, 1954 (F. X. Williams), at flowers of small prostrate *Euphorbia; allotype*, male, same date, except October 12; both deposited in the California Academy of Sciences, San Francisco.

Named for its superficial resemblance to some of the species of wasps belonging to the genus *Nitelopterus*, in color, wing infuscation in the female, and small size. From the more typical *Tachysphex* the new species differs chiefly in its marginal cell distinctly surpassing the short third submarginal cell.

Tribe MISCOPHINI

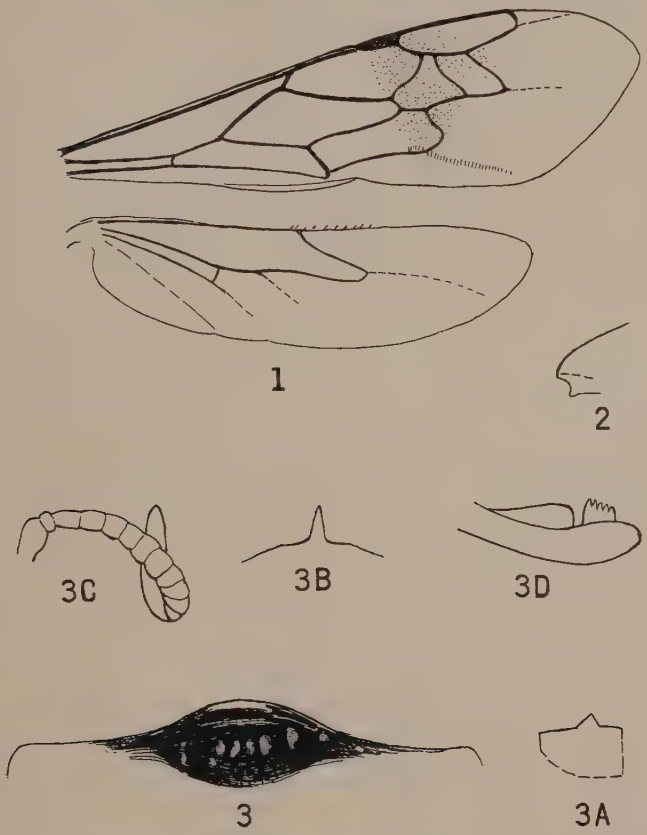
Solierella boregensis Williams, new species

(Figure 2)

Female holotype.—Length 5 mm. Black: mandibles reddish for apical half; lobes of pronotum, and tegulae in part, a long spot anteriorly beneath on femora 1 and 2, and a stripe above on tibiae 2 and 3, creamy white; tarsi chiefly reddish brown; abdomen red. Mandibles not emarginate beneath, malar space nearly two-thirds as long as width of mandible at base: clypeus broadly cuneate anteriorly, its apex very slightly extended toothlike, and with a sharp arched carina that is well above the true apical clypeal margin, this raised portion as seen in lateral profile is emarginate and drops steeply to the clypeal margin. A well-formed V arises mesad above the antennae and expands broadly and less definitely to the compound eyes that each ridge follows to partly embrace the posterior ocelli. Ocelli forming approximately a right-angle triangle; vertex rather coarsely punctate, subshining; antennae slender, articles 3 and 4 subequal, their apical width about twice their length. Scutum and scutellum shining, the moderate punctures well spaced, thus not forming any subcoriaceous areas, pleurae largely reticulate; disc of propodeum, with a median furrow, sides very finely striate, posterior face with rather coarse striae and a subtriangular depression. Fore tarsi with a comb of sparse bristles, there being one long bristle on articles 1–4, those on 1–3 fully twice as long as the middle width of their respective articles. First recurrent and the first transverse-cubital veins interstitial. Abdomen shining, closely and finely hair-punctate. Vestiture: silvery pile, dense on frons, clypeus, genae, base of pronotum, pleurae, edging of propodeal disc, legs in part, and somewhat banding the abdomen.

Male allotype.—Length 4 mm. Slender. Black; mandibles reddish for their apical half; prothoracic lobes, a long spot anterioly beneath on femora

1 and 2, and a stripe above on all tibiae, tegulae in part, creamy white, tarsi brownish; ablomen red, but the base and apex in part blackish. Clypeus with the median portion tumid though slightly angled in profile, cuneate anteriorly and provided with a strong keel that in lateral profile ends as a simple and



Explanation of Figures

Fig. 1, *Tachysphex nitelopteroides* Williams. Female, holotype. Fig. 2, *Solierella boregensis* Williams. Female, holotype. Clypeus distal end in lateral aspect to show vertical emargination. Fig. 3, *Solierella semirugosa* Williams. Female, holotype. Clypeus in fronta aspect; 3A, Female. Coxa to show dorsal process. 3B, Male, allotype. Clypeus, anterior margin; 3C, Male, allotype. Antenna to show the naturally reflexed 13th segment. 3D, Male, allotype. Aedeagal lobe, lateral aspect.

rather gross point: mandibles not excavate beneath, malar space from 3/4 to 4/5 the width of a mandible at base: antennae rather slender, thickest from articles 3–10, article 3 expanding from its base so that the length is less than twice its apical width, articles 3 and 4 subequal, 13 about 1/3 longer than 12. Scutum and scutellum shining, rather closely punctate, pleurae shining and strongly punctate: disc of propodeum subopaque, granulate and with a strong median groove, pleurae with a fine granulate appearance. First recurrent vein almost attaining the second submarginl cell. Abdomen shining, finely and closely hair-punctate, the segments not thickened apically. Aedeagus, as in a paratype of *Solierella vierecki* (Rohwer) from Boulder, Colorado, with the exception that in *S. boregensis* there is a very slight emargination along the outer (non-dentate) side of the uncal lobe. Vestiture: dense silvery pile, as in female.

Holotype female and allotype male. Borego. San Diego County, California, April 29. 1955, (F. X. Williams) deposited in the California Academy of Sciences.

Differs from *Solierella vierecki* (Rohwer), its near relative, that also occurs in the Borego Desert area, but has been more commonly found in the lower foothills region about La Mesa, near San Diego, in being much more heavily clothed with silvery pile, which obscures the frontal carinae, the V appearing slightly narrower in the new species. *Solierella boregensis* has no pronotal markings, the dorsulum is polished and much less strongly punctate than in *S. vierecki*, where these surfaces are partly coriaceous. In *S. boregensis*, holotype, ♀, the clypeus shows a vertical emargination, and the fore tarsal bristles are long, whereas in *S. vierecki* these are minute.

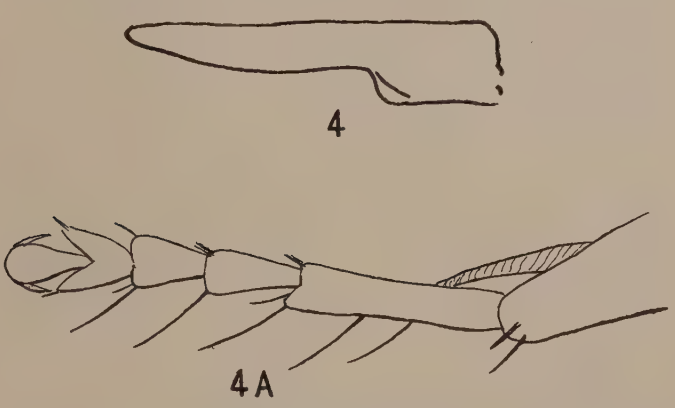
Solierella semirugosa Williams, new species

(Figures 3–3D)

Female holotype.—Length 4.2 mm. Black: generally shining above; mandibles black at extreme base, then whitish to about middle, thence reddish; apex of scape beneath testaceous: apical portion of pronotal lobes, tegulae in part, postscutellum, a long spot beneath from apex of fore femora, a shorter spot on mid femora, and a stripe above on all tibiae, creamy white tinged with yellow; venation brownish, paler at wing bases, apex of fore wings slightly infumate: abdomen red, its extreme apex in part fuscous. Head much wider than high; clypeus widely arched mesad, disc tumid, not carinate, with strong punctures for its basal half and a good polished margin; mandibles only slightly emarginate beneath: practically no malar space: frons with the low rounded interantennal ridge expanding as a V-shaped subopaque and rugulosely punctate area that rather suddenly widens to extend to the compound eyes to limit the vertex anteriorly; antennae slenderly subclavate, articles 3 and 4 subequal: vertex shining but closely and rather coarsely punctate: ocelli in approximately a right-angle triangles,

posterior ocelli somewhat more than their diameter from the compound eyes, these ocelli outwardly lying in a shallow depression. Pronotum short, collar somewhat sugulose; scutum and scutellum polished, with well separated punctures, the pleural punctation heavier, largely obscured by the silvery pile; disc of propodeum without bounding carinae, shining, coarsely sculptured, with a median carina in a groove that is strongest apically, and with well-spaced oblique and transverse carinulae, pleurae striate reticulate, posterior face with a wide shining top-shaped depression and rather coarse transverse striae. Bristles of fore tarsal comb, segments 1–4, generally one and one-half times longer than the width of their respective tarsal segments, in addition, there are two shorter spines anteriorly along the middle of fore tarsal segment 1, these spines a little longer than the width of the segment at their origin; dorsal process of hind coxae acute; second submarginal cell subtriangular, first and second submarginal cells each receiving a recurrent vein. Abdomen shining, with some very fine close punctures; pygidial area marked laterally by dark, short close-set bristles. Vestiture: silvery pile on the lower frons, genae, base of pronotum, mesopleurae, borders of propodeal disc, and rather incompletely banding the abdominal tergites.

Male allotype.—Length 4 mm. Black; marked as in female except abdomen has only an indication of reddish on the apex of some tergites, and the tarsal segments are generally creamy white; puncturation is about as in the female. Non-carinate clypeus with median gibbous portion strongly punctate and with a stout spike arising from its otherwise subtruncate margin; malar space about equal to one-half the width of the mandible at base; antennae with the 12 articles shorter than in female, article 13 greatly elongate so as to equal the sum of the six preceding articles,



EXPLANATION OF FIGURES

Fig. 4, *Solierella mandibularis* Williams. Female, holotype. Mandible from outer side, 4; fore tarsal comb, 4A.

and it is strongly hinged backwards, be the wasp alive or dead; the two posterior ocelli bounded posteriorly by a shallow, gently procurved depression that extends across the vertex. Aedeagal lobes, as viewed from side, each shows a short elevated row of teeth on the subclavate apical portion, while basad of this is an elongate lobe.

Holotype female and allotype male in fresh condition, BOREGO, SAN DIEGO COUNTY, CALIFORNIA, April 23 and 29, 1955, respectively (F. X. Williams). Paratypes: 3 females and 24 males, topotypical, taken in late April, 1955, May 11 and 12, 1955, and 2 females, topotypical, April 30, 1957 (F. X. Williams); all or nearly all these specimens were taken on *Euphorbia polycarpa*. Other paratypes of *Solierella semirugosa* are, 1 female, Borego, San Diego County, California, April 25, 1955 (P. D. Hurd), 1 female, Hopkins Wells, Riverside County, California (E. G. Linsley), 1 male, Palm Springs, Riverside County, June 2, 1953 (R. M. Bohart), 1 male, Davis, Yolo County, California, August 13, 1955 (R. M. Bohart) and 1 male, Davis, August 20, 1955 (A. T. McClay).

Perhaps closest to *Solierella timberlakei* Williams (1950), of which only the female holotype is known (locality, six miles south of Palm Springs, Colorado Desert, California). The male of *Solierella semirugosa* is easily recognized by its stout clypeal spike, backwards-directed 13th antennal segment and the lamina before the raised aedeagal comb. The female has the fore tarsal comb of bristles that are distinctly longer than the length of the middle joints of the fore tarsus, in *Solierella timberlakei* these *bristles* are only about half the length of the middle joints.

Solierella mandibularis Williams, new species

(Figures 4 and 4A)

Female holotype.—Length 3.75 mm. Black; moderately shining and generally closely punctate; mandibles reddish apically, dull yellow mesad, black at base; two wide pronotal spots, edge of pronotal lobes, postscutellum, femora 1 and 2 with a spot anteriorly beneath, tibiae above, chiefly dull yellow; tarsi pale yellow to brown; venation testaceous. Head reticulate-punctate. Middle part of clypeus convex, shining, punctations few except at base, not carinate, margin truncate, marginal strip rather wide. Mandibles with a strong notch beneath near base; malar space at middle nearly equal to basal width of mandibles. Antennae rather slender, article 3 a little shorter than 4. Ocelli in about an equilateral triangle. Thorax closely punctate, metapleurae polished. Disc of propodeum reticulate, with some diverging basal striae and an apical trough, pleurae reticulate, posterior face reticulate and with some widely spaced transverse carinulae and a V-like

depression. Fore tarsal comb consisting of long pale spines of which there are three on segment 1, and one each on segments 2 and 3, and all of a length well exceeding the diameter of the tarsal segments at the point of attachment of these spines. Second submarginal cell receiving second recurrent vein. Tergites strongly punctate. Vestiture: moderate silvery pile.

Holotype female from Cronise Valley, San Bernardino County, California, April 29, 1956; on *Prosopis* (P. D. Hurd, collector) and is on deposit in the California Academy of Sciences. Male unknown.

Separated from *Solierella albipes* (Ashmead) and *S. bridwelli* Williams by having a tarsal comb and by its much more generous malar space. The ventral mandibular notches are about equal in *S. mandibularis* and *S. albipes*, but in *S. briwelli* it is much less developed.

PHORETIC SCELIONIDS ON GRASSHOPPERS OF THE GENUS MELANOPLUS

(Hymenoptera:Scelionidae)

U. N. Lanham and F. C. Evans

Saline Valley Farms, Saline, Michigan, and
Department of Zoology, University of Michigan

In the course of an ecological study of the insect fauna of an old-field community[1] in southern Livingston County, Michigan, a number of grasshoppers of the genus *Melanoplus* were collected with one, two or three adult winged parasitic wasps, *Scelio bisulcus* (Ashmead), clinging to the undersurface of the abdomen. The numerous references in the literature to scelionids on North American grasshoppers are apparently based on two early records: that of Ashmead (1893:241) for a specimen of *Scelio* found on a "short-winged locust" and that of Warner (1903) for another taken from *Dichromorpha viridis*. Ashmead supposed that the wasp attaches itself to the grasshopper with the intention of finding out where the eggs were to be deposited. Recently, Channa Basavanna (1953) observed individuals of *Lepidoscelio viatrix* to leave the Indian grasshopper *Orthacris (Colemania)* when it oviposited and to lay their eggs in its egg masses. A general discussion of the phoretic relationship between scelionids and grasshoppers, together with a photograph of *L. viatrix* attached to its orthopteran host, was published by Brues (1917).

The abandoned field, situated on the Edwin S. George Reserve

[1] This project is supported by a grant (G-3223) from the National Science Foundation.

of the University of Michigan, is a 12-acre plot bordered by oak-hickory woodlots and covered with mixed grasses (especially *Poa compressa* and *Aristida purpurascens*) and a variety of forbs. It has not been cultivated for more than 30 years and is now infiltrated with widely scattered seedlings of hardwoods and junipers. In 1957, four species of *Melanoplus* — *keeleri luridus* (Dodge), *c. confusus* Scudder, *f.-r. femur-rubrum* (De Geer), and *m. mexicanus* (Saussure)—were collected from the field. The last species was relatively uncommon. Scelionid wasps were observed on 13 individuals of the first three species, as follows:

keeleri luridus: one wasp on each of five specimens—July 31, September 3, 5.

c. confusus: seven wasps on four specimens, one grasshopper with three, one with two wasps—July 15.

f.r. femur-rubrum: one wasp on each of four specimens—September 5, 9, 14.

These specimens were collected by U. N. Lanham, R. E. Lanham and F. C. Evans. All the wasps and their grasshopper hosts were adult females; none of several hundred male and immature grasshoppers that were examined carried wasps. So persistently did the wasps cling to the grasshoppers that one was still attached after its host had thumped about in a small cardboard box for an hour or more, and others held on with a death grip when in cyanide tubes. The wasps had seized with their jaws the intersegmental membranes at the anterior end of the abdomen, beneath and on the lower sides and no farther back than the second suture. All faced the same direction as the grasshopper. The strongly depressed body form, unusual for a hymenopteran, would seem to fit them well for their mode of transport.

We are indebted to C. F. Muesebeck for identification of the wasps and to I. J. Cantrall for that of the grasshoppers.

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A RECORD OF AGABUS SEMIVITTATUS LeCONTE FROM CALIFORNIA

(Coleoptera:Dytiscidae)

Hugh B. Leech
California Academy of Sciences, San Francisco

Agabus semivittatus LeConte

Agabus semivittatus LeConte, 1852. Ann. Lyceum Nat. Hist. New York, 5:204.
Agabus spilotus LeConte, 1859. Smithson. Contrib. Knowl., 2 (Art. 6):5.
Agabus texanus Sharp, 1882. Sci. Trans, Roy. Dublin Soc., (2) 2:505.

It seems to have escaped notice for a long time that the type of *Agabus semivittatus* LeConte was from California. So far as I know it had not been found again in California for over a hundred years, until Dr. John Belkin and party took a male and two females at China Ranch, Inyo County, on May 30, 1955. China Ranch is just south of Tecopa, near the San Bernardino County line. The species is not included in my key to those known from the state (1956:319–321).

LeConte's original description gives merely "Colorado" as the type locality. This actually refers to the Colorado Desert of California. In the introduction to his paper (1851:125) he wrote, "My collection was made in the following manner: . . . San Diego, in May, June and September; Vallecitas [now Vallecitos] and the Desert of the Colorado, in October and November; Colorado River, December and March; Valley of the Gila, in January and February." since he specified "Ad flumen Colorado" for many other cases in this paper, it is fair to presume that he meant the Colorado desert for *A. semivittatus*; he may have found it in some small source of water in what is now the Imperial Valley. It is interesting to note that the then dry bed of the present Salton Sea was not discovered and explored until 1853–54.

LeConte (1863:17) placed his *A. spilotus* (Fort Laramie [Wyoming]) as a variety of *A. semivittatus*, and Crotch (1873: 417) made it a synonym; I have specimens compared with the types by Dr. P. J. Darlington, Jr. Fall (1922:10), in listing *A. texanus* Sharp as a probable synonym, wrote "Some examples, more especially those from Texas and the southwest are a little less evenly oval than the typical form of the species . . .", as if the typical form was not from the southwest. On the basis of 12 Texas and 34 Arizona specimens studied, I, too, doubt there is

any basis for a division of the species, but if a subspecies is named it will have to be from the eastern part of its range, since the three names already proposed are all for western material.

In addition to the localities given by Fall, I have seen specimens from UTAH: St. George. KANSAS: Douglas County; Onaga. SOUTH DAKOTA: Rapid City. OKLAHOMA: Wichita National Forest; McClain County; Norman. ARKANSAS: Bentonville. MISSOURI: St. Louis; Ranken; Columbia. MICHIGAN: South Haven; E. S. George Reserve, Livingston County. TENNESSEE: Elmwood. VIRGINIA: (state record only). PENNSYLVANIA: Bear Lake; Clarks Valley; Easton; Wind Gap. NEW JERSEY: Colonia; Phillipsburg; Princeton. NEW YORK: Chautauqua; Jones Beach; Ithaca; Long Beach; Meadowdale; N. Lebanon. MASSACHUSETTS: Framingham; Natick. QUEBEC: Como.

In my key to the California species (1956:319–321) *A. semivittatus* will trace to couplet 9, where it will not fit either choice, since the prosternal process is rather broad and flat, but not sharply acuminate, while there is only a partial row of punctures paralleling the lower posterior margin of the hind tibia. If put through the second choice it will run to couplet 15, where it fits the second part except that the elytral reticulation is as fine in the female as in the male. From there it could be traced to *A. approximatus* Fall, but is immediately distinguished by the dark epipleurae, broad, flat prosternal process, and sharply rectangular hind angles of the pronotum. The male of *A. semivittatus* has the anterior protarsal claw toothed near the base, and the aedeagus is simple apically, not bifid in profile.

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A STRIDULATORY MECHANISM IN ARHAPHE CICINDELOIDES WALKER

(Hemiptera:Heteroptera:Pyrrhocoridae)

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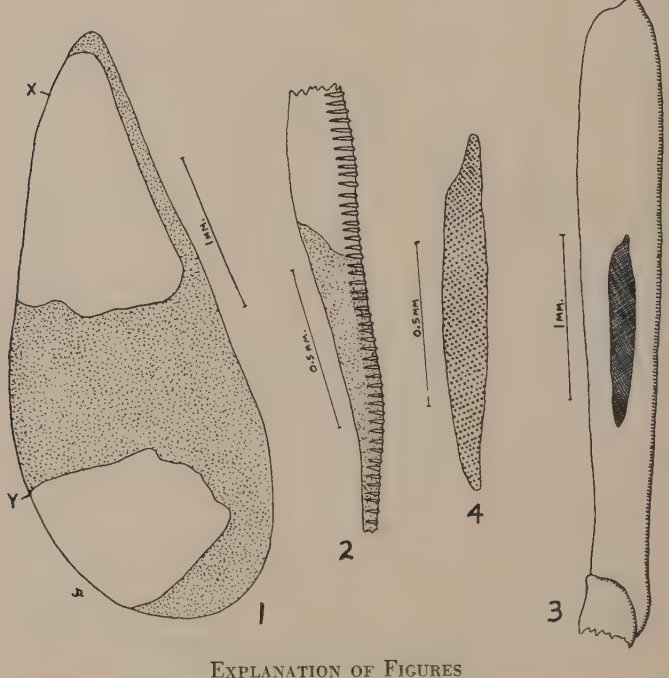
Stridulation in the Heteroptera has received only limited attention during the long period that this taxon has been studied. The recent summary by Leston (1957) has provided a thorough review of the accumulated knowledge on the subject. As Leston states (*loc. cit.*, p. 370), only the Aradidae (Usinger, 1954) and the Pentatomorpha (Leston, 1954) have received recent treatment. When the general paucity of information is considered, it is perhaps unwise to draw sweeping conclusions based on such a small amount of information. This is particularly true in the face of conclusions reached by Usinger (*loc. cit.*, p. 543) in the Aradidae, in which he feels that stridulatory mechanisms have arisen independently at least five times within that family and are not of any fundamental phylogenetic significance. Investigation now in progress tends to support this idea in the Lygaeidae. That they may prove valuable in certain groups is demonstrated by Leston (1957:372), in which all of the genera of Cydnidae examined exhibited the same type of wing strigil. Thus, as with any character, its relative value must be determined for each group under consideration before broad generalizations can be made.

A structure of apparent stridulatory nature was observed in *Arhaphe cicindeloides* Walker during the routine identification of a small collection of Heteroptera. The stationary portion, or

strigil, is located on the outer edge of the hemelytron, occupying most of the margin (Fig. 1). The strigil consists of series of short ridges running at right angles to the long axis of the wing (Fig. 2). These ridges are approximately 0.04 mm. long and there are about 38 ridges per millimeter. The mobile portion, or plectrum, is located on the caudal surface of the hind femur in a central position (Fig. 3). It consists of an elongate area with minute papillae arranged in rows (Fig. 4). This portion is rubbed against the wing margin. The mechanism is found in both sexes. A literature search has failed to disclose any previous mention of a stridulatory mechanism in the genus *Arhaphe* or in the family Pyrrhocoridae.



Explanation of Figures

Stridulatory mechanism of *Arhaphe cicindeloides* Walker. Fig. 1, Left hemelytron (setation omitted). X-Y indicates region occupied by strigil. Fig. 2, Lateral view of portion of hemelytron showing details of strigil. Fig. 3, Left rear femur, caudal view, showing location and extent of plectrum. Fig. 4, Enlargement of plectrum showing arrangement of minute papillae.

Mr. Peter D. Ashlock, University of California, Berkeley, kindly checked the two other species of *Arhaphe*, *A. breviata* Barber and *A. carolina* H.–S. in the collections of the California Academy of Sciences and states that they have a mechanism similar to that found in *A. cicindeloides*. Thus the structure apparently is a generic character and should be added to the general generic description.

Arhaphe is included in the tribe Largini (Euryophthalmini) of the Larginae (Euryophthalminae) by Hussey (1929). *Japetus* and *Thaumastaneis*, the other myrmecoid genera related to *Arhaphe*, should be examined for similar structures. Representatives of two other genera included in the Largini, *Largus* and *Stenomacra*, were examined but no stridulatory mechanisms were observed. A thorough study of sound producing organs within the relatively small family Pyrrhocoridae would do much to further our knowledge of the systematic value of these structures.

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NOTES ON THE COLLECTION OF PHLEBOTOMUS STEWARTI MANGABIERA AND GALINDO

(Diptera: Psychodidae)

The collections of *Phlebotomus stewarti* Mangabiera and Galindo were made while collecting mosquitoes with an American model Mosquito Light Trap. The light source was a 50 watt white frosted vibration service bulb. The trap was located 10 feet from a stable with the light source five feet above the ground. The stable is located on a hillside approximately 100 yards from a small creek which runs most of the year, and there is also a

small, partially covered reservoir 30 feet from the light trap fed by a small spring.

The San Mateo County Mosquito Abatement District operated five light traps throughout the District from March 1 to November 1, 1956. The insects collected from the light traps were sorted for mosquitoes and later sorted again for *Phlebotomus*. Only the trap stationed on the Hooper Estate, Woodside, California, produced *Phlebotomus stewarti*. The collection of insects was removed from the light trap and brought to the laboratory every other day. The first occurrence was on the first of June when 26 specimens were collected. This figure represents three trap nights.

The following data gives the numbers and the dates the specimens were trapped:

		♂	♀			♂	♀			♂	♀
June 1st	(26)	6	20	Aug. 3rd	(2)		2	Oct. 1st	(4)	3	1
6th	(none)			8th	(3)	1	2	5th	(4)		4
11th	(3)	1	2	13th	(6)	1	5	10th	(21)	3	18
15th	(9)	2	7	22nd	(4)	1	3				
July 18th	(2)		2	Sept. 5th	(18)	2	16				
25th	(8)	2	6	11th	(16)	2	14				
				14th	(2)		2				
				19th	(14)	3	11				
				24th	(12)	1	11				

A total of 154 adults of *P. stewarti* were taken during the period of June 1 until October 10. Close examination did not reveal any specimens taken after October 10 or before June 1. Also the collections indicated a definite break of adults on October 10. It is curious that the two peak collections are the first day and the last day they were collected.

A search of the eaves about the barn and adjacent pump house did not produce any *Phlebotomus* although other psychodids were present under the eaves and in the shrubbery. From the available literature this collection appears to be the first in San Mateo County. It is possible that a close look at light trap collections may turn up more records of *Phlebotomus* in the State.

I wish to thank Dr. L. W. Quate for his determination of the specimens even though the specimens were in such poor condition by being collected in the light trap.—THOMAS H. LAURET, *San Mateo County Mosquito Abatement District.*

BRACONID WASPS REARED FROM LEPIDOPTEROUS LARVAE IN ARIZONA, 1957 [1]

GEORGE D. BUTLER, JR.
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During 1957, approximately 12,000 lepidopterous larvae from crop areas in southern Arizona were reared to determine the numbers and kinds of insect parasites present. Individual larvae were collected from cotton, alfalfa, corn and sorghum, held in ½-pint waxed paper cups with transparent plastic lids and fed fresh alfalfa. The tachinid flies which emerged have been discussed by Butler (1958). This paper treats the braconid wasps.

Ten species and 55 individual rearings were obtained. These represent three subfamilies: Microgasterinae with four species of *Apanteles* and three of *Microplitis*, Cheloninae with a single species, *Chelonus texanus* Cresson, and Rogadinae, with two species of *Rogas*. The ten species are discussed below. Under each species there is a summary of the rearings and also of the adult records in the University of Arizona Collection, most of which were from a state-wide survey of the insects associated with crops, as described by Butler and Werner (1957) and Werner and Butler (1958). Two hundred and fifty adult records are included. Numbers in parenthesis in the text represent numbers of separate collections, not of specimens. All of the specimens, from rearings and survey, have been determined by C. F. W. Muesebeck. The author wishes to take this opportunity to thank Mr. Muesebeck for his kind assistance.

Apanteles marginiventris (Cresson).—A single specimen was reared from *Laphygma exigua* (Hübner) on cotton from Higley. Adult collection records indicate that this species is most abundant in Yuma (6) and Maricopa (11) Counties but there are single records from Santa Cruz and Gila Counties. Adults were swept from alfalfa (14), cotton (2), and Bermuda grass (1) during January (1), February (1), April (1), July (5), August (4), September (1) and November (6).

Apanteles medicaginis Muesebeck.—Ten rearings were made from *Colias philodice eurytheme* Boisduval. *A. medicaginis* is widely distributed throughout Arizona and it has been collected during the following months: January (2), June (5), July (2),

[1] Arizona Agriculture Experiment Station Journal Series Paper No. 478.

August (16), September (8), October (4), November (13) and December (1).

Apanteles militaris (Walsh).—Two rearing records were obtained for this parasite, one from *Laphygma exigua*, swept from alfalfa at Sahuarita in July, and the other from an unidentified dead caterpillar found on corn at Pearce in August. Twelve adult records were obtained from alfalfa. This species is generally distributed throughout southern Arizona and was collected during the following months: January (1), February (1), April (3), May (1), June (2), July (3), August (1) and November (2).

Apanteles sp., possibly new.—A single specimen was rearded from *Trichoplusia ni* (Hübner) from cotton southeast of Willcox in August.

Microplitis alaskensis Ashmead.—Four rearing records were obtained from *Trichoplusia ni* from cotton (2), alfalfa (1) and lettuce (1). Three adults were swept from alfalfa. Except for one collection from Navajo County, all collections were made in Cochise County. This species was taken in the summer, as follows: July (2), August (4), September (1) and November (1).

Microplitis brassicae Muesebeck.—Four rearing records were also obtained for this species from *Trichoplusia ni* but all from cotton. Two adults were swept from cotton and one from alfalfa. Adults were collected from Maricopa (4), Pima (1), Cochise (1) and Mohave (1) Counties in April (1), June (1), July (3) and August (2).

Microplitis croceipes (Cresson) is an important parasite of *Heliothis* spp. and 18 rearings were made from alfalfa (9), sorghum (6), cotton (2) and weeds (1). Collections of adults were from alfalfa (14), cotton (3), corn (1) and *Lepidium* (1). Adults were collected only in the central and south-eastern part of the state, during June (3), July (17), August (23), September (1) and October (1).

Chelonus texanus Cresson had the widest host range of the braconids reared. It was obtained from *Laphyma exigua* (7), *L. frugiperda* (J. E. Smith) (4), *Heliothis* sp. (1) and *Prodenia ornithogalli* Gueneé (1) on alfalfa (7), corn (4), cotton (1) and Swiss chard (1). Adults were swept from alfalfa (94), cotton (11) and Bermuda grass (2). *C. texanus* is very common in crop areas and was collected in every county and throughout the year except

during the winter. Monthly records are: March (2), April (2), May (6), June (19), July (43), August (27), September (21), October (6) and November (14).

Rogas molestus Cresson.—A single specimen of this species was reared from *Trichoplusia ni* on alfalfa at Amado in August.

Rogas perplexus Gahan.—Two rearings were obtained, one from *Trichoplusia ni* on alfalfa at Elfrida in July and the other from *Heliothis* sp. on cotton at Safford in August.

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THE PARASITES OF THE CLOVER SEED CHALCID IN THE UNITED STATES[1]

(Hymenoptera: Chalcidoidea)

GEORGE D. BUTLER, JR.[2] AND HARRY L. HANSEN[3]

The clover seed chalcid, *Bruchophagus gibbus* (Boheman), annually causes serious losses to alfalfa and clover seeds throughout the United States. Its destructiveness is reduced by a number of chalcidoid parasites. This paper presents a key for the identification of the clover seed chacid and its parasites and a brief summary of their areas of recorded occurrence and important sources of published information. The key and figures were prepared by B. D. Burks[4] and the distribution records are from Muesebeck *et al.* (1951) and Hansen (1955).

The following key to the clover seed chalcid and its parasites in the United States was prepared by Dr. B. D. Burks. This key was based on dry female specimens reared from alfalfa, clover or other

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[1] Arizona Agricultural Experiment Station Journal Series Paper No. 463.

[2] University of Arizona, Tucson.

[3] West Virginia University, Morgantown (Parasite records collected while a graduate student, University of California, Berkeley).

[4] U. S. Department of Agriculture, A. R. S., U. S. National Museum.

suitable hosts and is not designed for identification of fresh specimens from field sweepings.

Key to the Clover Seed Chalcid and its North American Parasites

(Females—Dry Reared Specimens)

1. Body dull black; pronotum semi-quadrate and thoracic notum with thimble-like punctations, fig. 1 ..... *Bruchophagus gibbus* (Boheman)

   Body partly or mostly shining metallic green, blue-green, or blue, never dull black; pronotum not semi-quadrate; thoracic notum not with thimble-like punctation 2

2. Virtually wingless, hindwings minute, forewings reduced to a pair of triangular vestiges which are normally held upright ..... *Eupelmella vesicularis* (Retzius)

   Wings fully developed, forewing long enough to reach or surpass the posterior end of the abdomen 3

3. Midtarsus with a ventral comb of short, black spines, fig. 3; mesothorax flattened dorsally and with a pair of logitudinal ridges ..... *Eupelmus* sp.

   Midtarsus without a ventral comb; thorax without logitudinal ridges 4

4. Ovipositor long, projecting for a distance at least one-half as great as length of abdomen, fig. 5 5

   Ovipositor projecting only slightly, fig. 4 7

5. Projecting portion of ovipositor one-half to two-thirds as long as abdomen ..... *Liodontomerus perplexus* Gahan

   Projecting portion of ovipositor longer than abdomen 6

6. Forewing clear ..... *Liodontomerus insuetus* Gahan

   Forewing with a large, vaguely defined dark spot behind the marginal vein ..... *Liodontomerus longfellowi* (Girault)

7. Hind tibia partly dark brown to black; thorax black or navy blue with 4 metallic blue or green spots anteriorly ..... *Trimeromicrus maculatus* Gahan

   Hind tibia entirely yellow or light tan thorax not black or navy blue with metallic spots 8

8. Scutellum with 2 dorsal, longitudinal grooves, fig. 2; tarsus with 4 segments 9

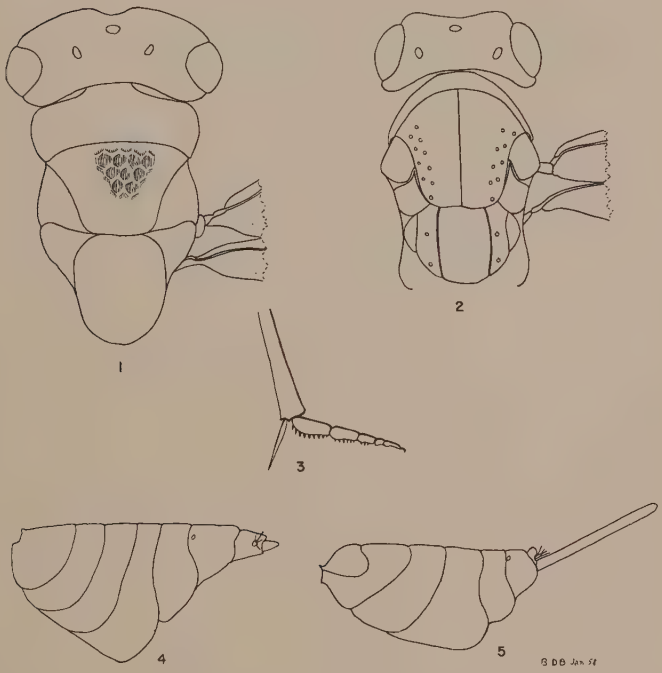
   Scutellum without dorsal, logitudinal grooves; tarsus with 5 segments 10

9. Body dark metallic blue; hind femora mostly dark ..... *Tetrastichus bruchophagi* Gahan*

   Body yellow with bright metallic green spots; hind femora mostly or entirely yellow ..... *Tetrastichus venustus* Gahan

* An occasional specimen has the hind tibae darkened; the heads of species of *Tetrastichus* almost always collapse when the specimens dry.

10. Central area of propodeum shagreened; antenna with 3 ring segments and 5 funicle segments.....*Amblymerus bruchophagi* (Gahan)
Central area of propodeum almost smooth, with a few obscure, oblique carinae; antenna with 2 ring segments and 6 funicle segments.....*Habrocytus medicaginis* Gahan



EXPLANATION OF FIGURES

Fig. 1, *Bruchophagus gibbus* (Boheman). Head and thorax, dorsal, showing bases of right wings and some sculpture; Fig. 2, *Tetrastichus bruchophagi* Gahan. Head and thorax, dorsal, showing bases of wings, setal pits, thoracic grooves; Fig. 3, *Eupelmus* sp. Mid tarsus; Fig. 4, *Habrocytus medicaginis* Gahan. Female abdomen, lateral aspect, showing ovipositor, cercus, and seven gastral segments; Fig. 5, *Liodontomerus perplexus* Gahan. Female abdomen, lateral aspect, showing exerted ovipositor, cercus, and seven gastral segments (abdominal segments III–IX). (Figures drawn by B. D. Burks, January 1958.)

FAMILY EULOPHIDAE

Tetrastichus bruchophagi Gahan

The females are dark blue-green in color except for a yellow apex on each femur and tibia. The tarsi are yellow except for the apical segment, which is dark. The antennae are dark brown and there are three funicular segments. The males are similar to the females except that the antennae have four funicular segments.

This species is generally distributed throughout the United States. It is the most active parasite of the clover seed chalcid in central California. Details of the life history and descriptions of the stages are given by Urbahns (1917). *T. bruchophagi* has also been reported as a hyperparasite of the alfalfa weevil parasite, *bathyplectes curculionis* (Thompson) (Muesebeck, *et al.* 1951).

Tetrastichus venustus Gahan

The females are yellow with metallic green spots. The male is usually all dark metallic green, with the ventral half of the frons yellow.

This is a rare parasite although the recorded distribution includes Arizona, California, Indiana and Iowa. Urbahns (1920) reared this species in small numbers from alfalfa seed but other workers have not found it.

FAMILY EUPELMIDAE

Eupelmus sp.

Urbahns (1920) records a single larva dissected from an alfalfa seed from Pasadena, California. Other workers have not encountered this species.

Eupelmella vesicularis (Retzius)

This species is listed as being parasitic on 42 host species, including the clover seed chalcid. Its distribution is recorded as Maine to Virginia and also Colorado, Oregon, Tennessee, Utah and Washington. Sorenson (1934b) found only an "occasional" specimen in Utah. Males are not known from North America.

FAMILY TORYMIDAE

Liodontomerus insuetus Gahan

The females are similar to *L. perplexus* except that the fore-

wings are clear with no evidence of a fuscous spot in the median area. The ovipositor is slightly longer than the abdomen, which is bronzy in color and has the tergites tinged with green basally. The males of the three species of *Liodontomerus* look very much alike, but the genus can be recognized in the male by having the cerci exserted and at the apex of abdominal tergite IX, not biscuit-like and located anterior to that margin.

The distribution of this species includes Arizona, California, Kansas, New Mexico and Oklahoma. It is only rarely collected in these states. Some locality records are discussed by Urbahns (1920).

LIODONTOMERUS LONGFELLOWI (Girault)

This species has been often referred to as *L. secundus*. The females of *L. longfellowi* differ from *L. perplexus* in that the segments of the antennal funicle are subquadrate, in that there is always a vaguely defined fuscous spot in the median area of the forewing and in that the ovipositor is distinctly longer than the abdomen. The male is similar to the female except for the short abdomen and other secondary sexual characters.

L. longfellowi is recorded primarily from the northern half of the United States. It has only been found associated with the clover seed chalcid on red clover. The recorded distribution is Idaho, Iowa, Minnesota, Ohio, Oregon, West Virginia (a new record) and Wisconsin. Urbahns (1919) studied the life history of this species.

LIODONTOMERUS PERPLEXUS Gahan

The females of this species have the head and thorax brassy green, the abdomen bronzy above and darker on the sides. The segments of the antennal funicle are broader than long. The forewings may or may not have a cloudy area in the median portion. The ovipositor is about two-thirds as long as the abdomen. The males are similar to the females except that the third flagellar segment is reduced and appears similar to a ring joint and the abdomen is very short and blunt. The upper parts of the legs are darker green than the body with the extemities yellowish.

This species is only associated with the clover seed chalcid

on alfalfa. It is widely distributed, with records from Arizona, California, Colorado, Idaho, Iowa, Nebraska, North Dakota, Oklahoma, South Dakota, Utah and Washington. A detailed description of the stages and the life history is given by Urbahns (1919).

FAMILY PTEROMALIDAE

Amblymerus bruchophagi (Gahan)

This species has also been called *Eutelus bruchophagi* Gahan. The female is similar in size and shape to the clover seed chalcid. The head is broad with dark brown eyes and antennae. The head and thorax are blackish-green, the legs are dark brownish or reddish-brown with the tarsi paler. The male is smaller than the clover seed chalcid. Its head and body are a bright metallic green. The antennae are bright yellow with a black club. The eyes are brown and the legs reddish-yellow.

The distribution of this species includes the states of Idaho, Utah, Wyoming and northern California. It emerges earlier in the spring than the clover seed chalcid or its other parasites. Urbahns (1919) discusses the biology and Sorenson (1930) discusses the adults and (1934a,b) gives rearing and sweeping records.

Habrocytus medicaginis Gahan

The female resembles *Amblymerus bruchophagi* in size and general appearance. *H. medicaginis* has two ring segments in the antennae while *A. bruchophagi* has three. *H. medicaginis* is bluish or bronzy green in general coloration. The head is broader than long in width, slightly exceeds the width of the thorax. The antennae are brown. The anterior margin of the pronotum is sharp. The males look very much like *Trimeromicrus maculatus* but can be separated by the difference in the number of ring segments, two in *Habrocytus* and three in *Trimeromicrus*.

This species has been reported from Arizona, California, Connecticut, Idaho, Iowa, Kansas, Minnesota, Nebraska, New Mexico, New York, Nevada, North Dakota, South Dakota, Utah, Washington and Wisconsin. Urbahns (1916) gives a detailed account of the life history of this species and it is mentioned by Sorenson (1930, 1943a,b).

TRIMEROMICRUS MACULATUS Gahan

The females are purplish black with four pale blue-green spots on the mesoscutum, one anteriorly on each side of the median line and another on the scapulae. The first abdominal tergite is brassy green, the following tergites are green except for broad black apical borders. The males are similar to the females except the abdomen is short and blunt and there are no pale spots on the thorax.

It is found in Arizona, California, Illinois, Kansas, New Mexico, South Dakota, Utah and Washington. This species is considered to be an important parasite in Arizona and California. Urbahns (1919) discusses its life history and distribution. Other hosts which *T. maculatus* attacks are the sunflower seed weevil, *Desmoris fulvus* (LeConte) and the alfalfa gall midge, *Asphondylia websteri* (Felt).

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SYNONOMY OF DINODERUS PUBICOLLIS VAN DYKE

(Coleoptera: Bostrichidae)

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Examination of the type series of *Dinoderus pubicollis* Van Dyke showed that it consisted of two previously described species. Dr. Vrydagh verified this from paratypes, and mentioned it in his revision of the genus (1956:495–496), but kindly left the fuller announcement to me.

Fisher, knowing Van Dyke's species only by description, included it in his key (1950:25) to the species recorded from North America north of Mexico (but including Baja California). For other synonymies, see his paper.

DINODERUS (DINODERASTES) JAPONICUS Lesne

Dinoderus japonicus Lesne, 1895. Ann. Soc. ent France, 64(1):170.
Dinoderus pubicollis Van Dyke, 1923 *(partim)*. Bull. Brooklyn Ent. Soc., 18(2):45. **New synonymy.**

The type and six paratypes[1] are *D. japonicus*.

As the recorded host plant is bamboo, it is possible that Van Dyke's specimens, all from Los Angeles, California, were not actually dug out of mesquite wood.

DINODERUS (DINODERUS) MINUTUS (Fabricius)

Apate minutus Fabricius, 1775. Systema Entomologiae, p. 54.
Dinoderus pubicollis Van Dyke, 1923 *(partim)*. Bull. Brooklyn Ent. Soc., 18(2):45. **New synonymy.**

Three paratypes of *D. pubicollis* are *D. minutus*.

The larvae of this species breed in bamboos and canes. All specimens of the type series of *D. pubicollis* are labeled simply "Los Angeles Co. Cal.".

DINODERUS (DINODERUS) BREVIS Horn

Dinoderus brevis Horn, 1878. Proc. Amer. Philos. Soc., 17:549 (in key), 550–551 (descr.).

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[1] In his description Van Dyke referred to the "Type and nine paratypes", but he actually wrote out labels for only four of them.

Fisher (1950:28) lists this as intercepted in bamboo in five states. To these may be added California, where examples were taken at Berkeley in November, 1934, in bamboo from Calcutta, India.

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BOOK REVIEW

THE INVERTEBRATA, A MANUAL FOR THE USE OF STUDENTS, by L. A. Borradaile and F. A. Potts, with chapters by L. E. S. Eastham and J. T. Saunders. 3rd ed. revised by G. A. Kerkut. Cambridge Univ. Press. American Branch: 32 East 57th Street, N.Y. pp. xvii + 795, 523 figs., 1958. Price $8.50.

This new edition of a standard text will be welcomed by those who used earlier editions and presumably by future generations of students. In the new edition information is organized under each group with a "diagnosis" followed by a narrative account. The illustrations have been provided with full labels in place of the frustrating abbrevations of earlier editions. A terminal chapter summarizes for each group the important literature. This is perhaps the best innovation, though the choice of references is questionable in some instances.

Recent discoveries have been incorporated in some places, including the phylogenetically significant molluscan, Neopilina, but the Phylum Brachiata or Pogonophora is not mentioned, the Crustacean group Caphalocarida is overlooked and, as in earlier editions, the Symphyla are ignored. Also the Tardigrada, Pentastomida and Pycnogonida are reduced to orders of the Arachnida with no comment as to their unique features. These criticisms are serious in a book to which one looks for the latest views on fundamental relationships of invertebrate types.

It is stated on the jacket that the chapter on insects was completely re-written by Prof. Eastham. Certainly a revision was long overdue and the new version drops the Berlese theory of insect metamorphosis and adopts the now popular arrangements of Palaeoptera (Odonata, Ephemeroptera) and orthopteroid orders. Unfortunately, a few unaccountable deviations from the usual arrangement were adopted including the archaic "Rhynchota" for Hemiptera, and Planipennia for Neuroptera. The Strepsiptera were placed with the Hymenoptera rather than with the Coleoptera, possibly following the treatment in Grassé, Traité de Zoologie, but few if any specialists would agree with this. Also the Paraneoptera (Heterometabola or Exopterygota) are placed after the Holometabola, a strange and undefended sequence.

The treatment of the Apterygota also leaves something to be desired. Collembola and Protura are bracketed with Diplura with no mention of the significant differences that have led most recent authors to recognize the separate classes Myrientomata and Oligoentomata. To summarize, "Borradaile and Potts" is still the best textbook in invertebrates but the revision is uneven and lacking in depth at critical points.—R. L. USINGER, *University of California, Berkeley.*

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